

NAVAL TECHNICAL TRAINING COMMAND

STUDENTS GUIDE

for

SH-2F AUTOMATIC STABILATION EQUIPMENT

ORGANIZATIONAL MAINTENANCE COURSE

SECTION I (INFORMATION SHEETS)

SECTION IV (DIAGRAMS)

C-602-3386



CNTT N6353D (6-81)

NAVAL AIR MAINTENANCE TRAINING GROUP

For Training Purposes Only

NAVAL AIR MAINTENANCE TRAINING GROUP

STUDENT'S GUIDE

FOR

SH-2F AUTOMATIC STABILIZATION EQUIPMENT
ORGANIZATION MAINTENANCE COURSE

C-602-3386

SECTION I (INFORMATION SHEETS)

SECTION IV (DIAGRAMS)

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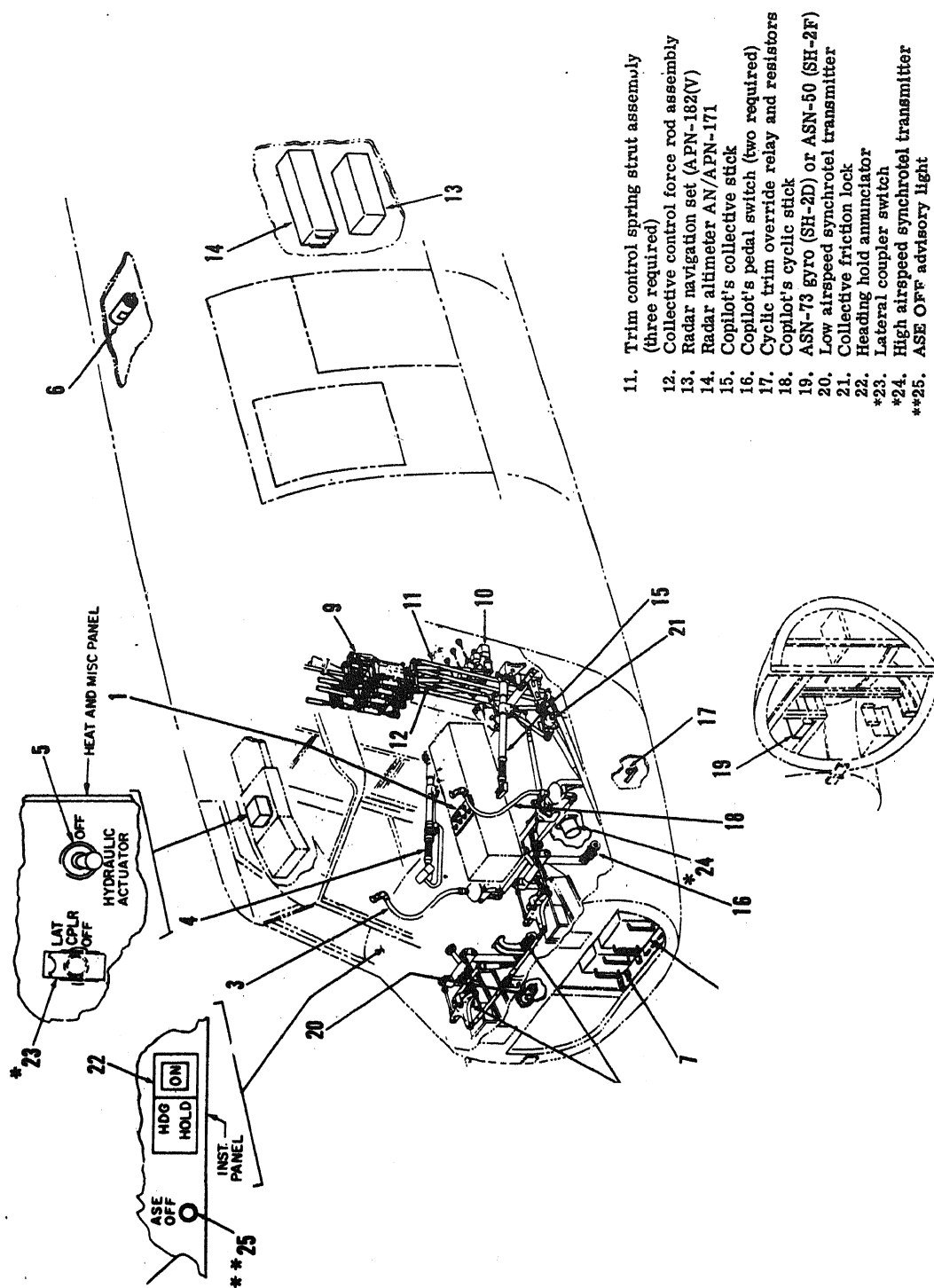
"Information sheets not in this course."

Table of Contents

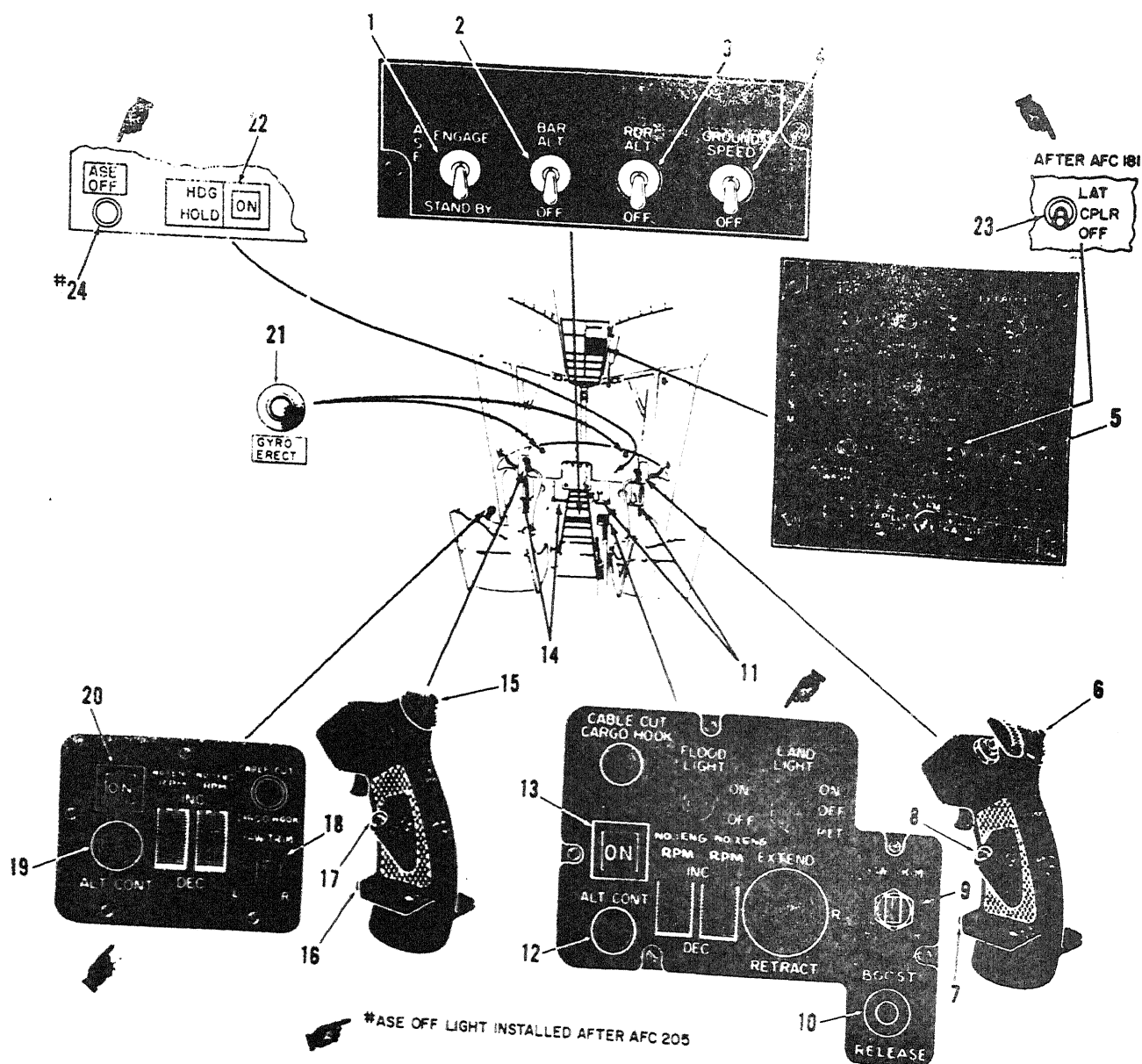
	<u>Page No.</u>
ASE - Component Location SH2D/SH2F	1
ASE - Operating Controls	2
Stabilization Amplifier (Cover Removed and Front Panel) and Sensor Unit Assembly - Major Components	3
Stabilization Amplifier - Component Identification	4
ASE Control Actuator - Front and Rear Views	5
ASE - Block Diagrams	6
ASE - Operating Controls Schematic	7
Time Delay and Power Interlock Circuit	8
Sensor Unit Assembly - Major Components and Sub-Chassis Assembly	9
Vertical Gyro	10
Co-pilots Remote Attitude Indicator	11
Rate Gyro	12
Accelerometer	13
Rotary Trim Actuators	14
Trim Control Spring Strut Assembly	15
Airspeed Synchrotel Transmitters	16
Stick Force Non-Linearity Circuit	17
Summing Network (Lateral-Directional) J140	18
Summing Network (Longitudinal - Collective) J120	19
Synchronizer Amplifier	20
Synchronizer	21
Principles Of Synchronization	22
Demodulator Amplifier Gain Control	23
Electro - Hydraulic Servo Valve - Schematic	24
LVDT Linear Variable Differential Transducer	25
Principles of Operation - ASE Electro - Hydraulic Servo Valve	26
Flight Line Test Set	27

Table Of Contents (cont.)

Flight Line Test Set Connected to Amplifier	28
Air Data Test Set	29
Lateral Collective Coupler Network J134	30
Control Actuator Accelerometer and Bobweight- Flow Diagram	31
Lateral Control Schematic and Roll Axis Block Diagram	32
Roll Channel Functional Schematics	33
Operational Check of Roll Channel	34-35
Magnetic Modulator Circuit	36
LV syn Transducer-Schematic	37
Motor Drive Amplifier	38
Longitudinal Control Schematic and Pitch Axis ASE Block Diagram	39
Pitch Channel - Functional Schematics	40
Operational Check of the Pitch Channel	41-42
Directional Control Schematic and Yaw Axis ASE Block Diagram	43
Pilot's and Copilot's Headings Disengage Switches	44
Yaw Channel - Functional Schematics	45
Operational Check of Yaw Channel	46-47
Altitude Controller	48
Collective Control Schematic and Altitude Control Block Diagram	49
Collective Channel - Functional Schematics	50
Adapter Cable Assemble, K604487-1	51
Operation Check of Collective Channel	52-53
Sensor Unit Schematic	54
ASE System Schematic	55

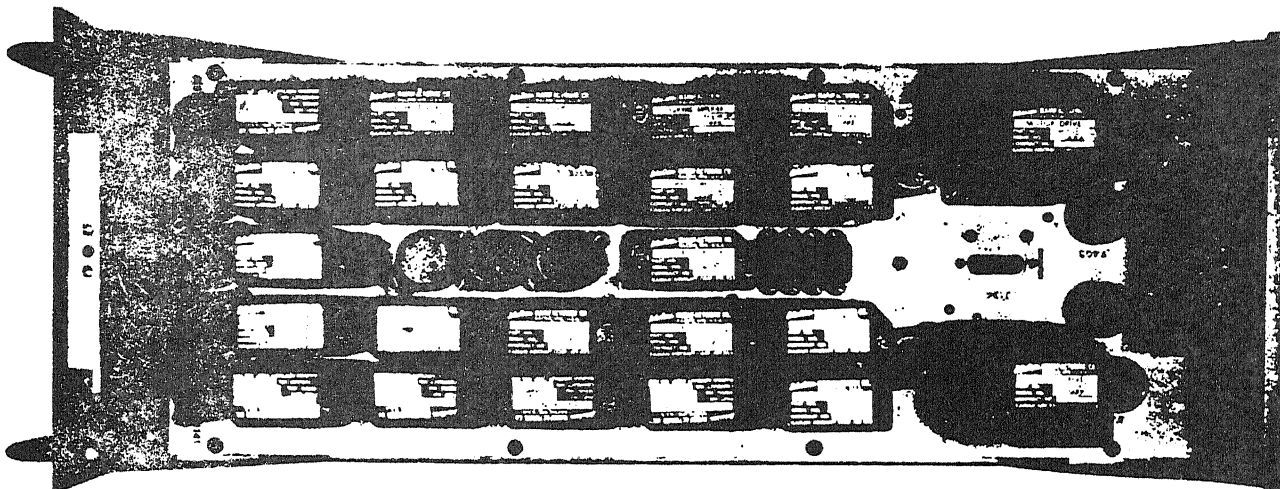


Component Location SH-2D/SH-2F



1. ASE control switch
2. Barometric altitude control switch
3. Radar altitude control switch
4. Groundspeed control switch
5. Hydraulic actuator switch
6. Pilot's cyclic trim switch
7. Pilot's ASE disengage button
8. Pilot's coordinated turn button
9. Pilot's yaw trim switch
10. Boost release switch
11. Pilot's heading disengage switches
12. Pilot's altitude control button
13. Pilot's altitude control annunciator
14. Copilot's heading disengage switches
15. Copilot's cyclic trim switch
16. Copilot's ASE disengage button
17. Copilot's coordinated turn button
18. Copilot's yaw trim switch
19. Copilot's altitude control button
20. Copilot's altitude control annunciator
21. Gyro quick-erect button
22. Heading hold annunciator
23. Lateral coupler switch
24. ASE - OFF light (After AFC 205)

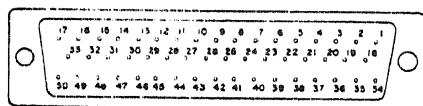
ASE - Operating Controls



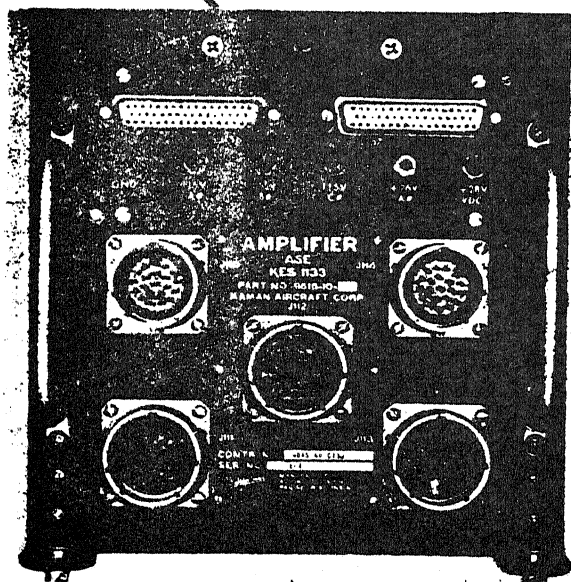
NOTE: MODULES J120 AND J140 ARE NOT HERMETICALLY SEALED IN THE STABILIZATION AMPLIFIER. SEE FIGURES 2-42 AND 2-44.

*MODULE J134 ADDED TO ASE AMPLIFIERS INC. AFC 181 (101 ROTOR SYSTEM). THIS MODULE IS NOT HERMETICALLY SEALED (REFER TO FIGURE 2-44A).

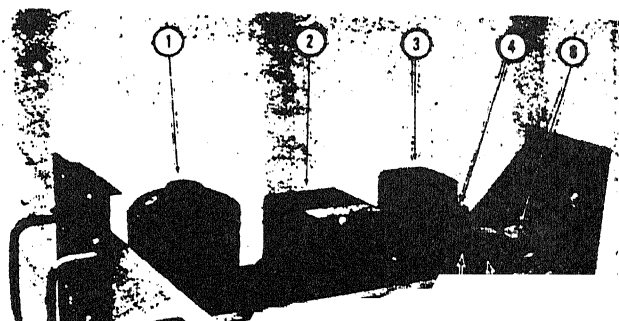
Stabilization Amplifier - Cover Removed



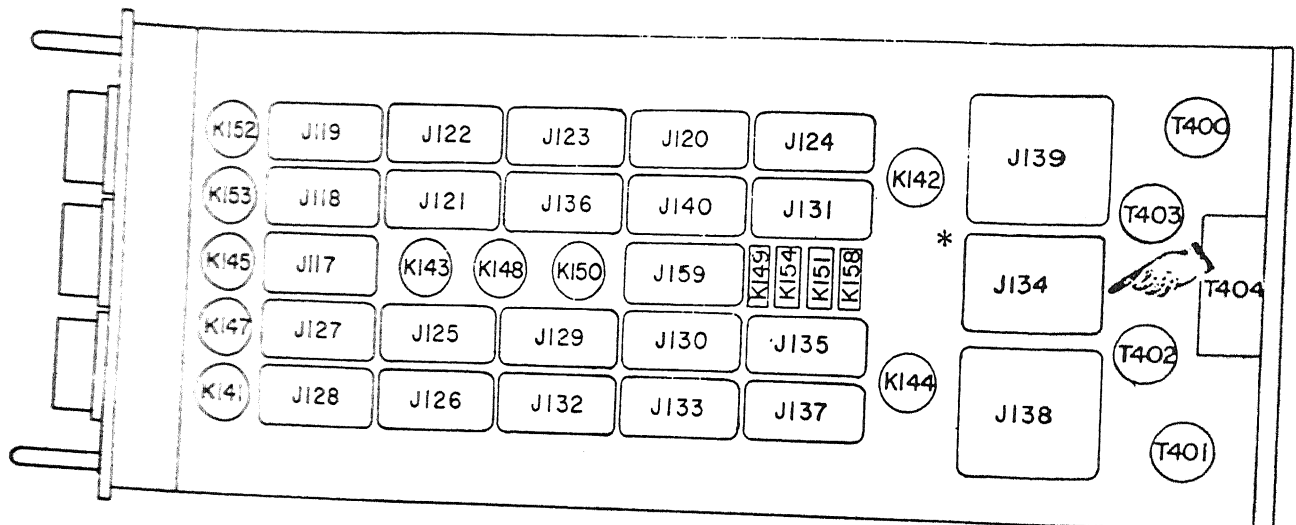
TYPICAL
BOTH
TEST
CONNECTORS



Stabilization Amplifier - Front Panel

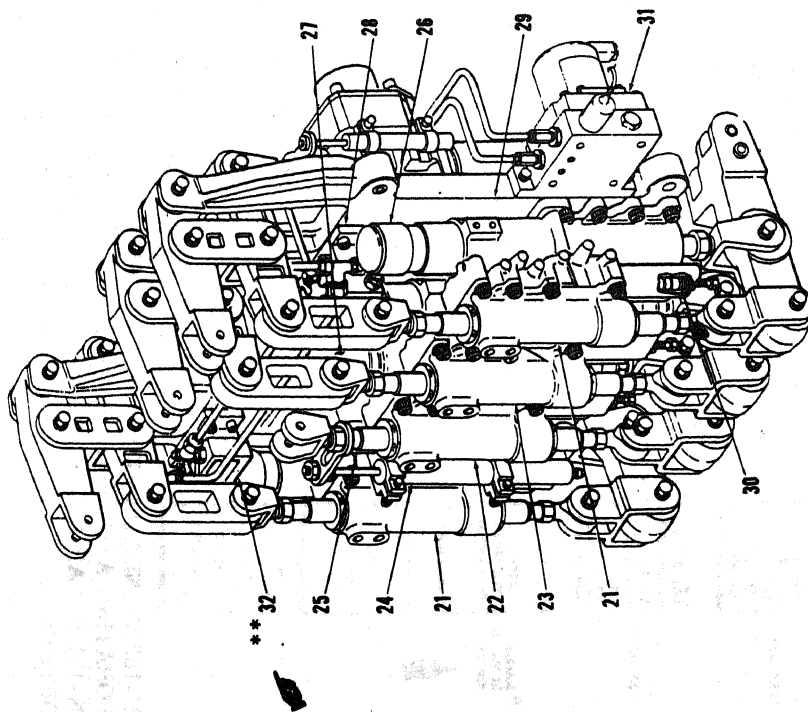


Stabilization Amplifier - Component Identification



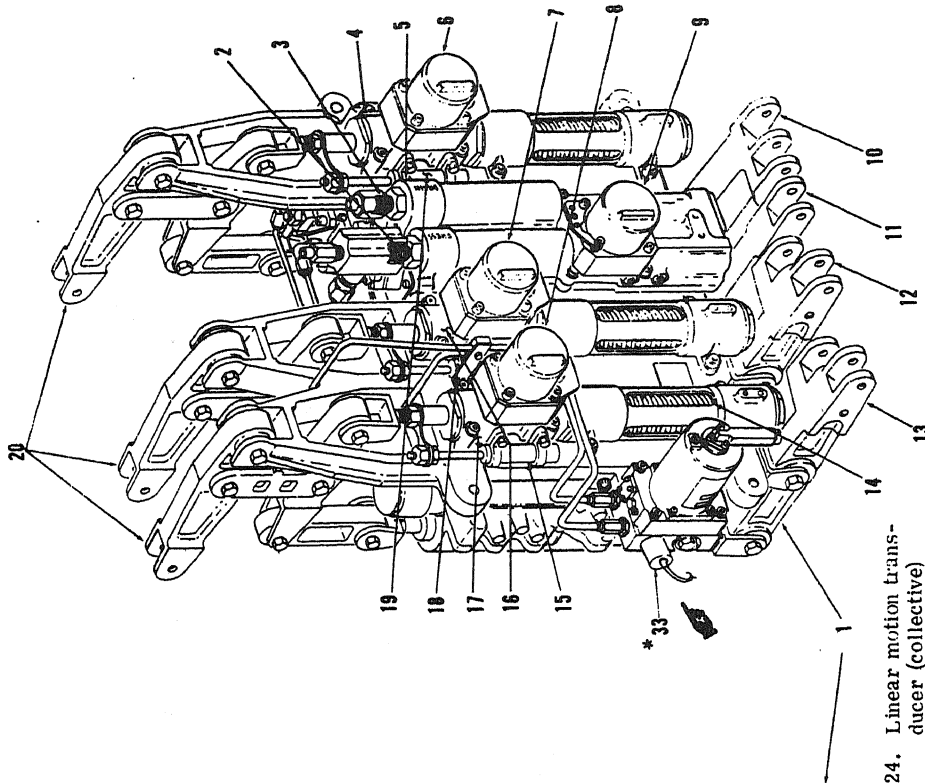
Key

- | | | |
|---------------------------------------------------------------|------------------------------------------|---------------------------------------|
| J117 BAR ALT synchronizer amplifier (for altitude controller) | J131 Demodulator amplifier (roll) | K145 BAR ALT control relay |
| J118 BAR ALT synchronizer amplifier | J132 Synchronizer (roll) | K147 RDR ALT control relay |
| J119 BAR ALT synchronizer | J133 Synchronizer (roll groundspeed) | K148 Pitch groundspeed relay |
| J120 Summing network (pitch-collective) | *J134 Lateral collective coupler network | K149 RDR ALT reliability relay |
| J121 RDR ALT synchronizer amplifier | J135 Synchronizer amplifier (heading) | K150 Roll groundspeed relay |
| J122 RDR ALT synchronizer | J136 Demodulator amplifier (heading) | K151 Power interlock relay |
| J123 Demodulator amplifier (collective) | J137 Synchronizer (heading) | K152 Power relay |
| J124 Demodulator amplifier (pitch) | J138 Motor drive amplifier (heading) | K153 Automatic coordinated turn relay |
| J125 Synchronizer amplifier (pitch) | J139 Motor drive amplifier (pitch) | K154 RDR ALT control relay |
| J126 Synchronizer (pitch) | J140 Summing network (roll-heading) | K158 Pedal force relay |
| J127 Synchronizer amplifier (pitch groundspeed) | J159 Relay driver (yaw rate) | T400 Transformer, phase-reversal |
| J128 Synchronizer (pitch groundspeed) | K141 Heading engage relay | T401 Transformer, stepdown |
| J129 Synchronizer amplifier (roll) | K142 Pitch attitude engage relay | K402 Transformer, stepdown |
| J130 Synchronizer amplifier (roll groundspeed) | K143 Roll attitude engage relay | T403 Transformer stepdown |
| | K144 Automatic pedal trim relay | T404 Transformer, power |



1. ASE control actuator assembly
2. Inlet fitting (system pressure)
3. Outlet fitting (system drain)
4. ASE actuator assembly (lateral)
5. Collective control valve assembly
6. Electro-hydraulic servo valve (lateral)
7. Electric-hydraulic servo valve (longitudinal)
8. Electro-hydraulic servo valve (directional)
9. Electro-hydraulic servo valve (collective)
10. Lateral input lever assembly
11. Collective input lever assembly
12. Longitudinal input lever assembly

13. Directional input lever assembly
14. Locking spring
15. Linear motion transducer (directional)
16. ASE actuator assembly (longitudinal)
17. ASE actuator assembly (directional)
18. Linear motion transducer (longitudinal)
19. Linear motion transducer (lateral)
20. Output lever assembly
21. Series output actuator assembly
22. Collective output actuator assembly
23. Series output actuator assembly

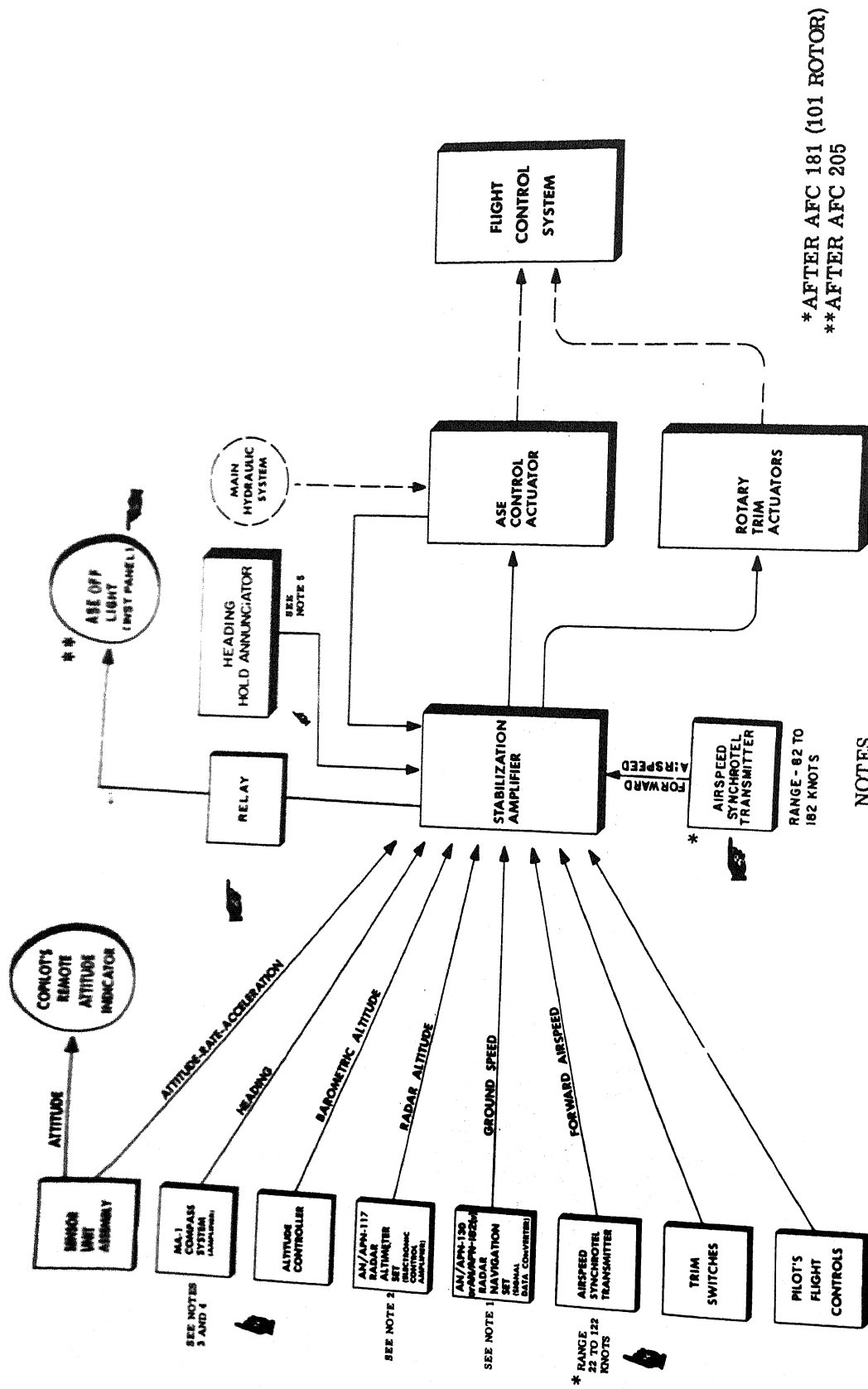


24. Linear motion transducer (collective)
25. Linear velocity transducer assembly
26. Series boost valve assembly (3 required)
27. Collective boost valve assembly
28. Longitudinal accelerometer actuator
29. Manifold assembly
30. Bypass valve
31. Accelerometer
32. Lateral accelerometer actuator
- * 33. Bobweight solenoid

ASE Control Actuator - Front and Rear Views

** NOT INSTALLED AFTER ECP 369

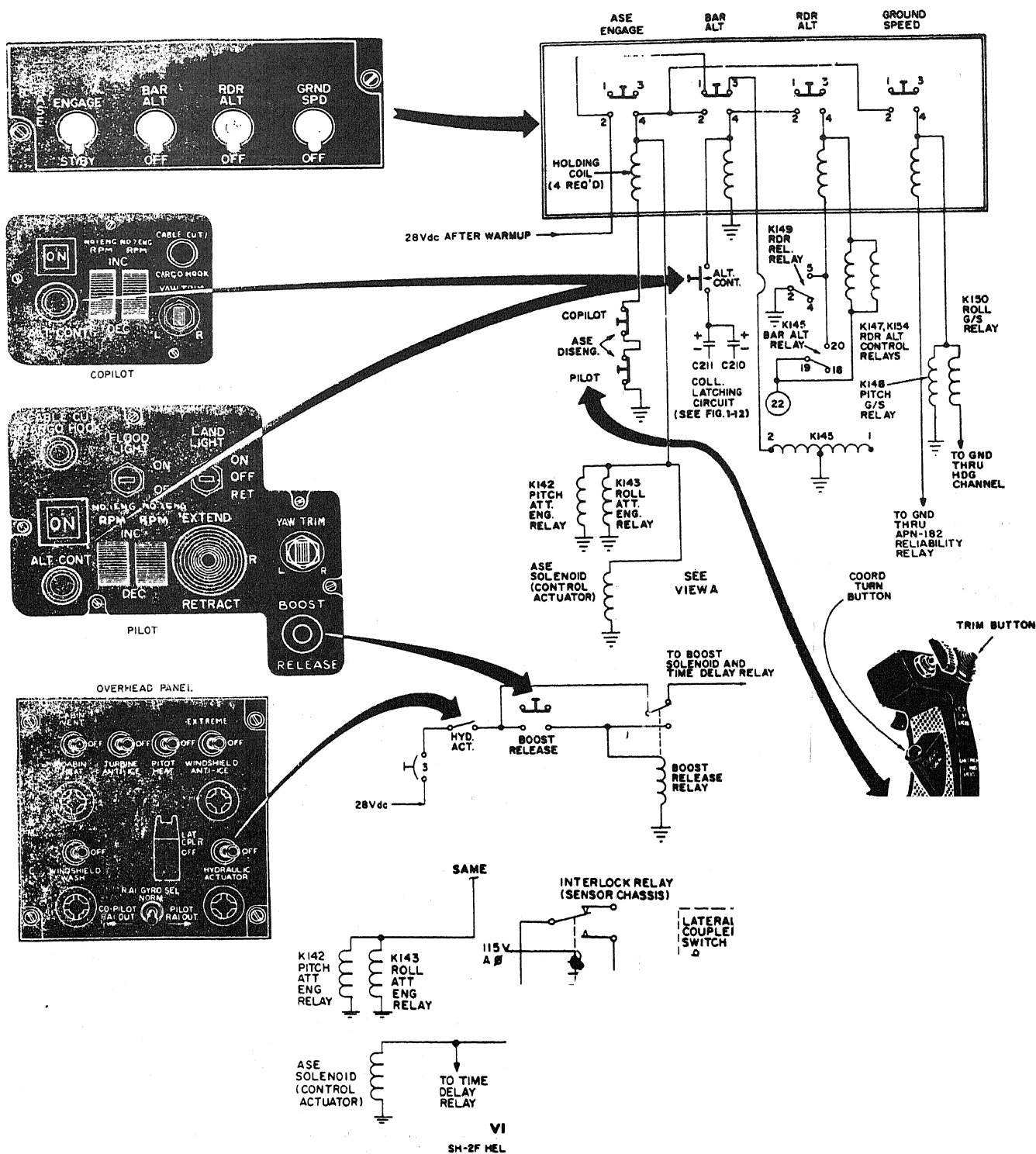
* AFTER ECP 369



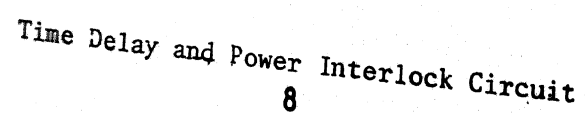
*AFTER AFC 181 (101 ROTOR)
 **AFTER AFC 205

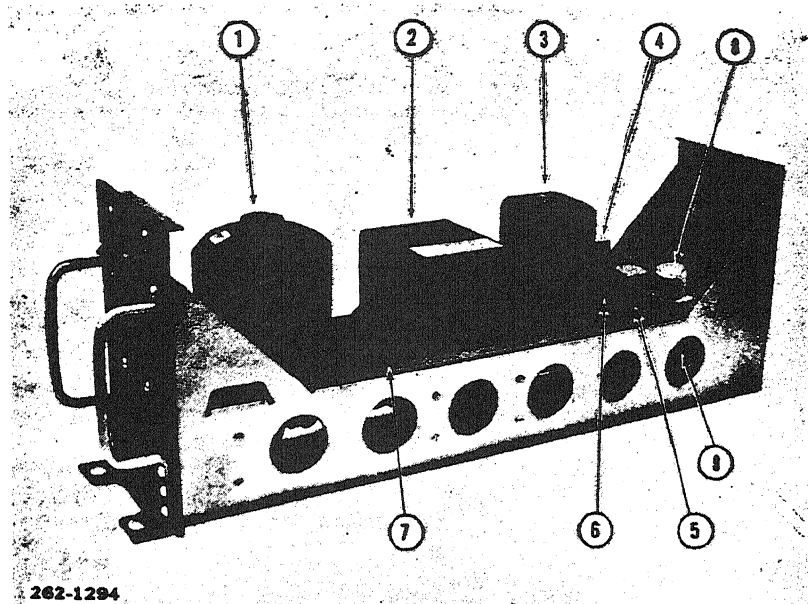
NOTES

1. AN/APN-182(V) INSTALLED IN SH-2D/SH-2F AND AIRCRAFT INCORPORATING AFC 179 OR AFC 179A1
2. AN/APN-171 RADAR ALTITUDE USED IN SH-2D/SH-2F HELICOPTERS
3. AN/ASN-73 ATTITUDE-HEADING SYSTEM USED IN SH-2D HELICOPTERS
4. AN/ASN-50 ATTITUDE-HEADING SYSTEM USED IN SH-2F HELICOPTERS
5. HEADING HOLD ANNUNCIATOR INSTALLED IN SH-2D/SH-2F ONLY.



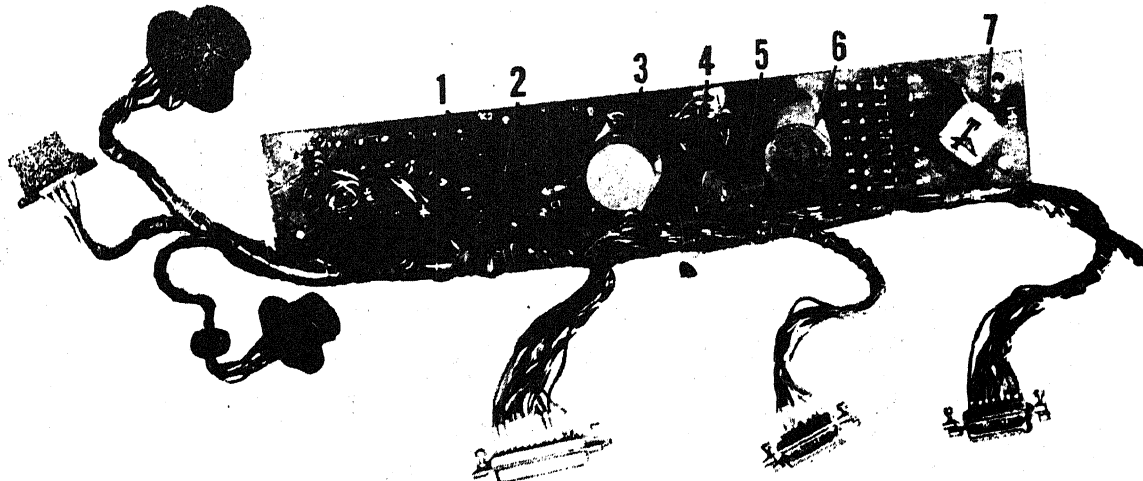
ASE - C





- | | |
|-----------------------|--------------------------------------------|
| 1. Vertical gyro | 6. Potentiometer |
| 2. Rate gyro package | 7. Deck plate assembly |
| 3. Accelerometer unit | 8. Coupler interlock relay |
| 4. Magnetic modulator | 9. Roll rate filter circuit board assembly |
| 5. Transformer | |

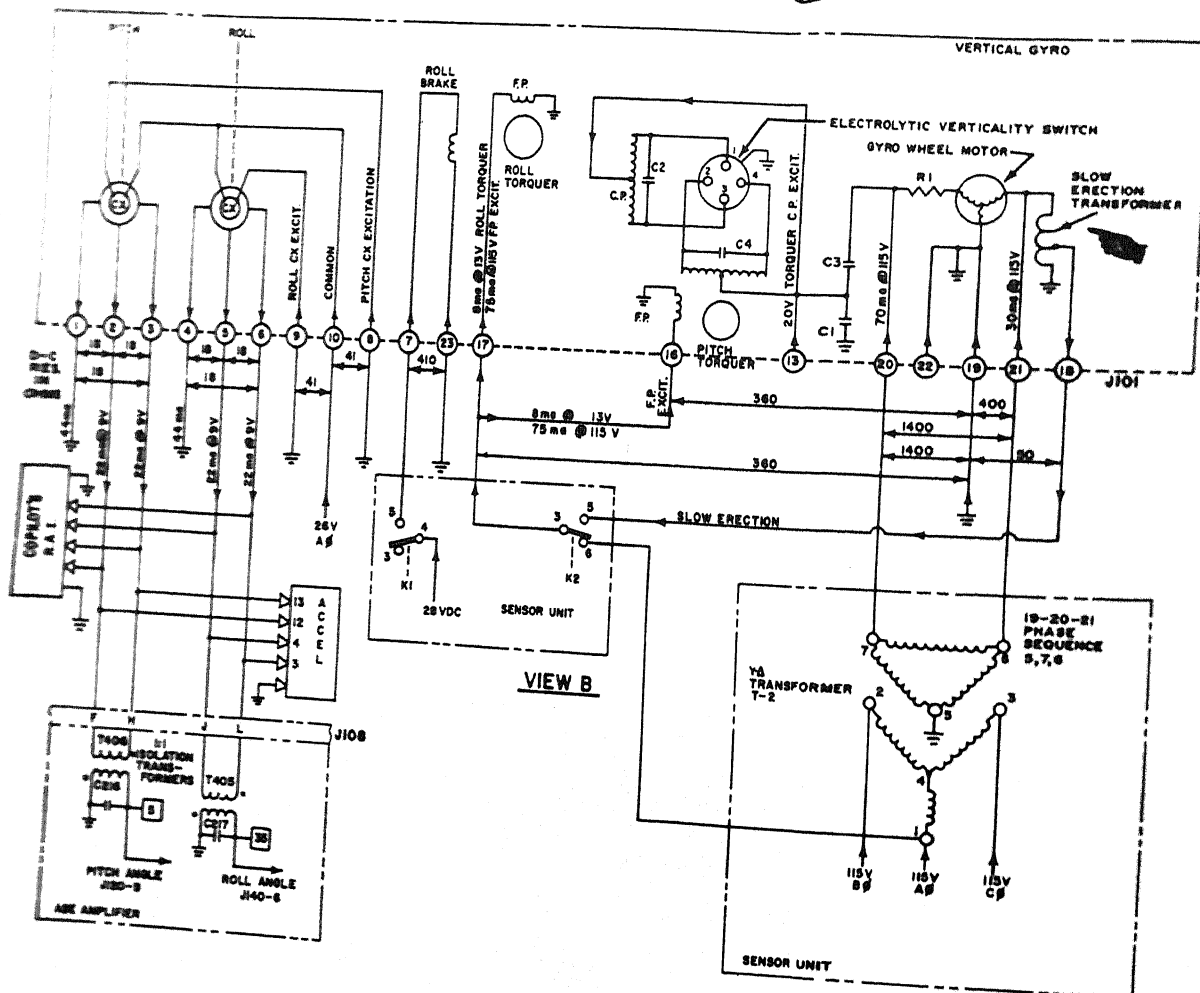
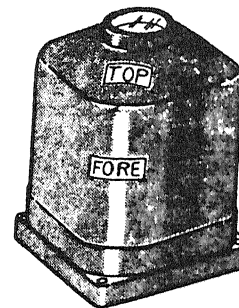
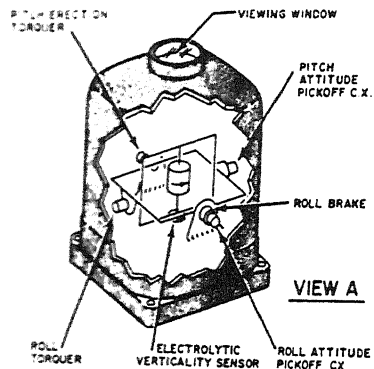
Sensor Unit Assembly - Major Components



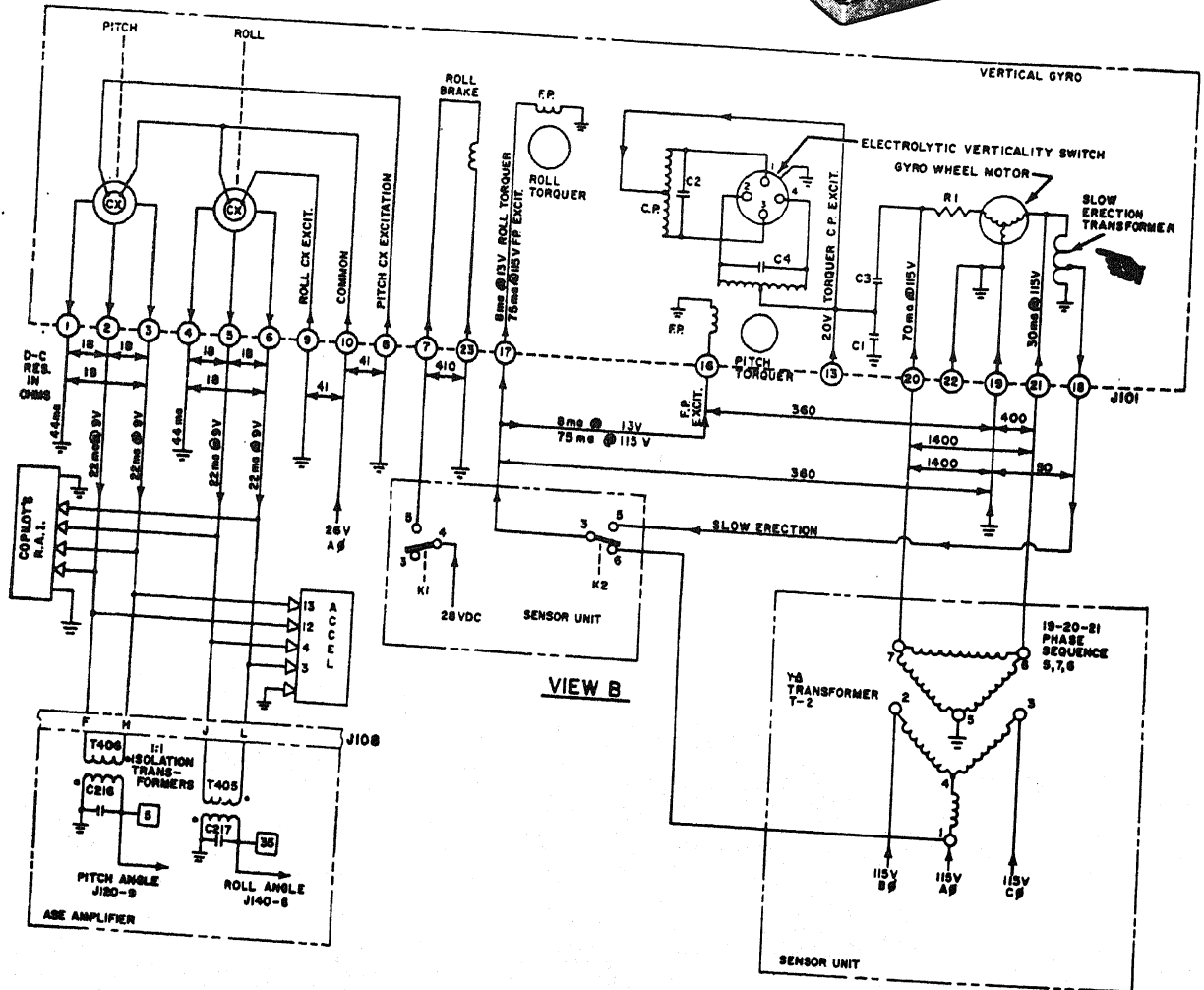
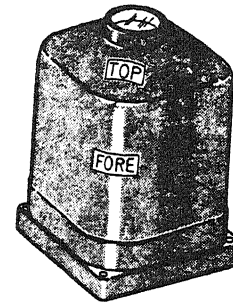
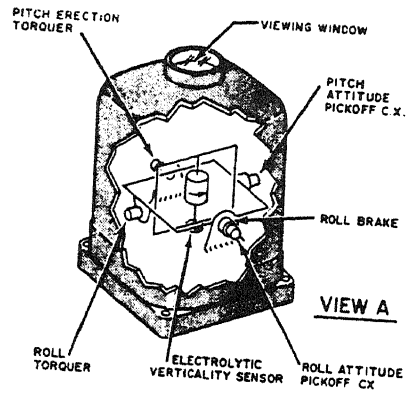
262-1295

- | | |
|-------------|-------------------|
| 1. Relay K2 | 5. Transformer T1 |
| 2. Relay K3 | 6. Transformer T2 |
| 3. Relay K1 | 7. Transformer T3 |
| 4. Relay K4 | |

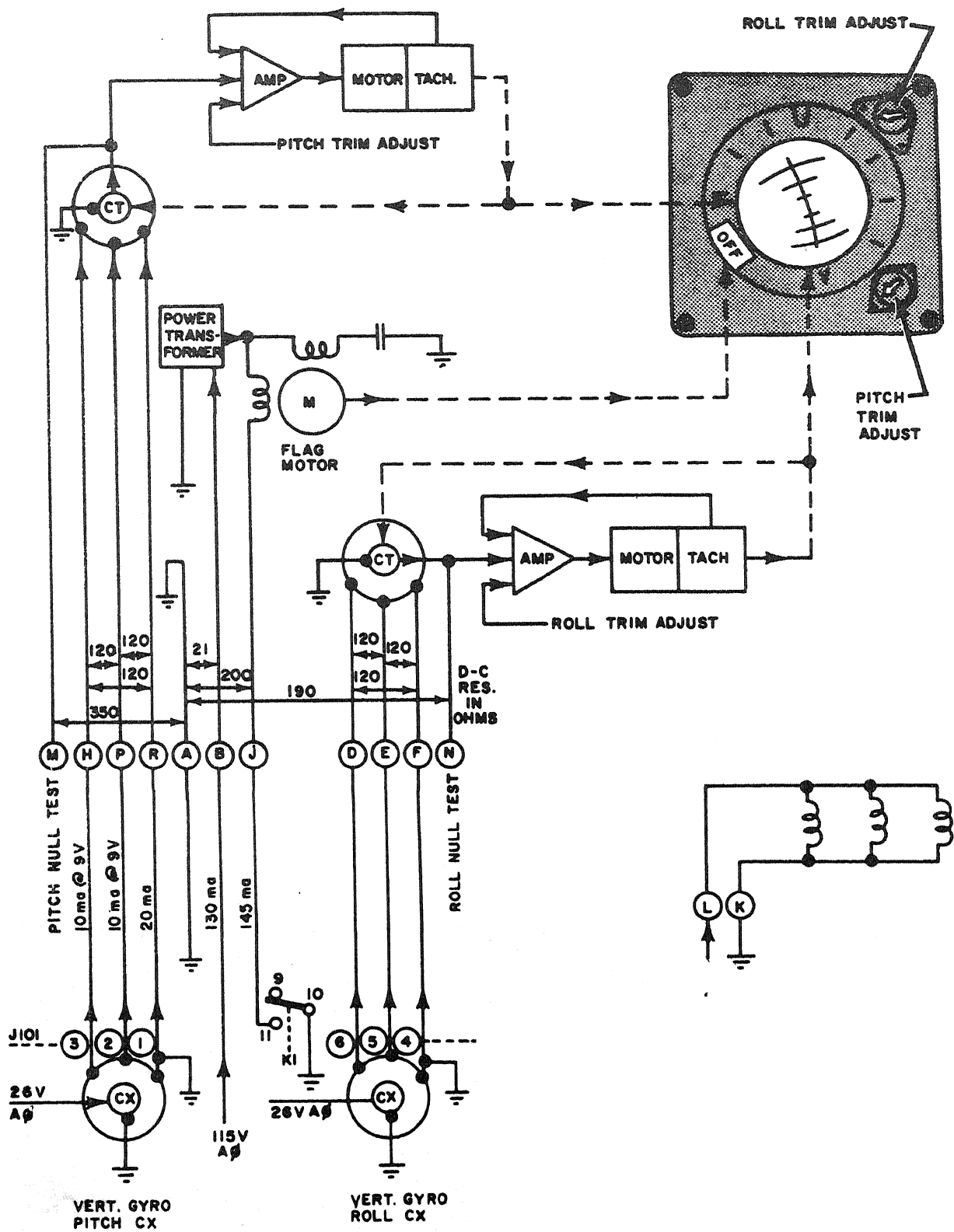
Sensor Unit Sub-Chassis Assembly



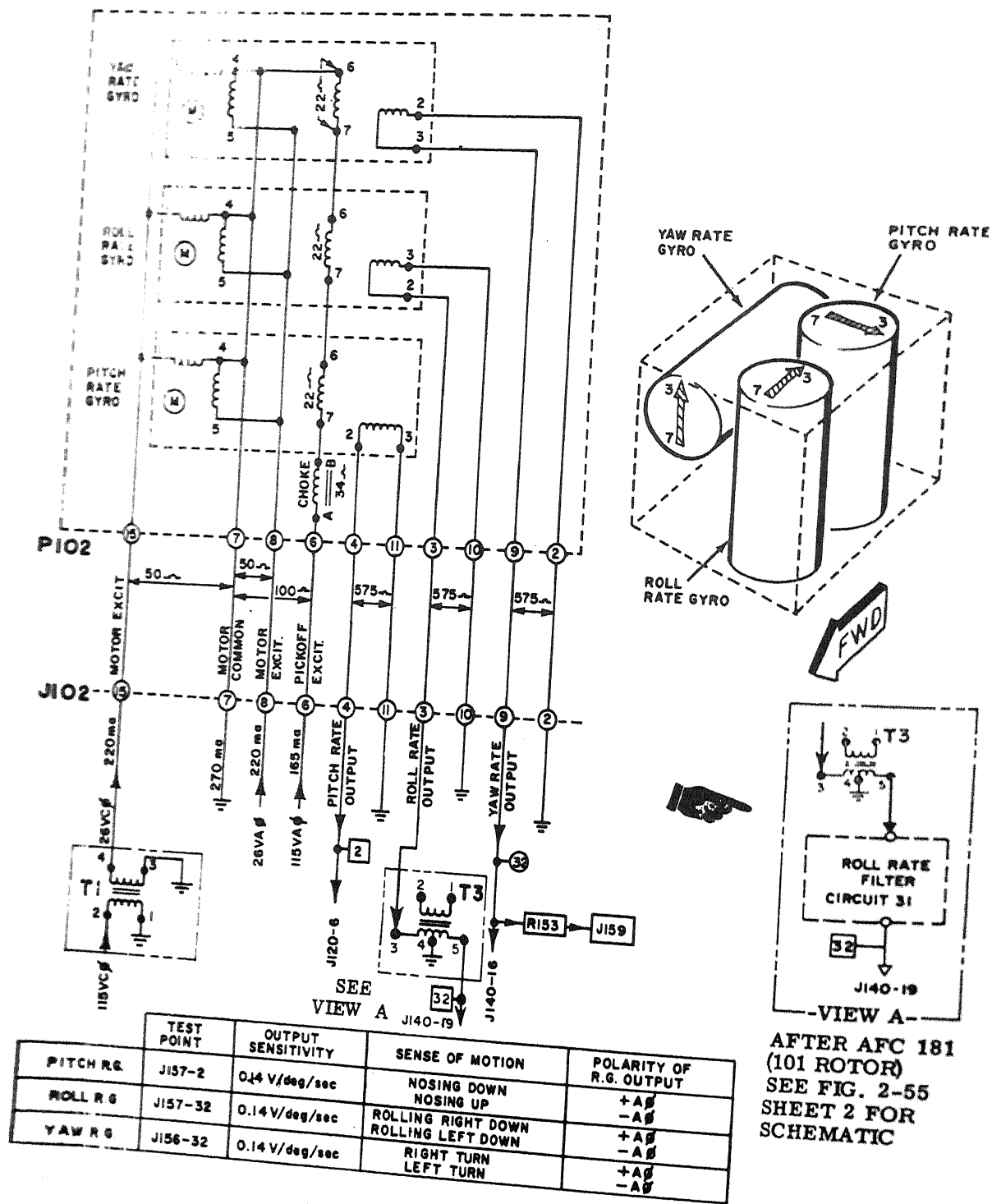
Vertical Gyro



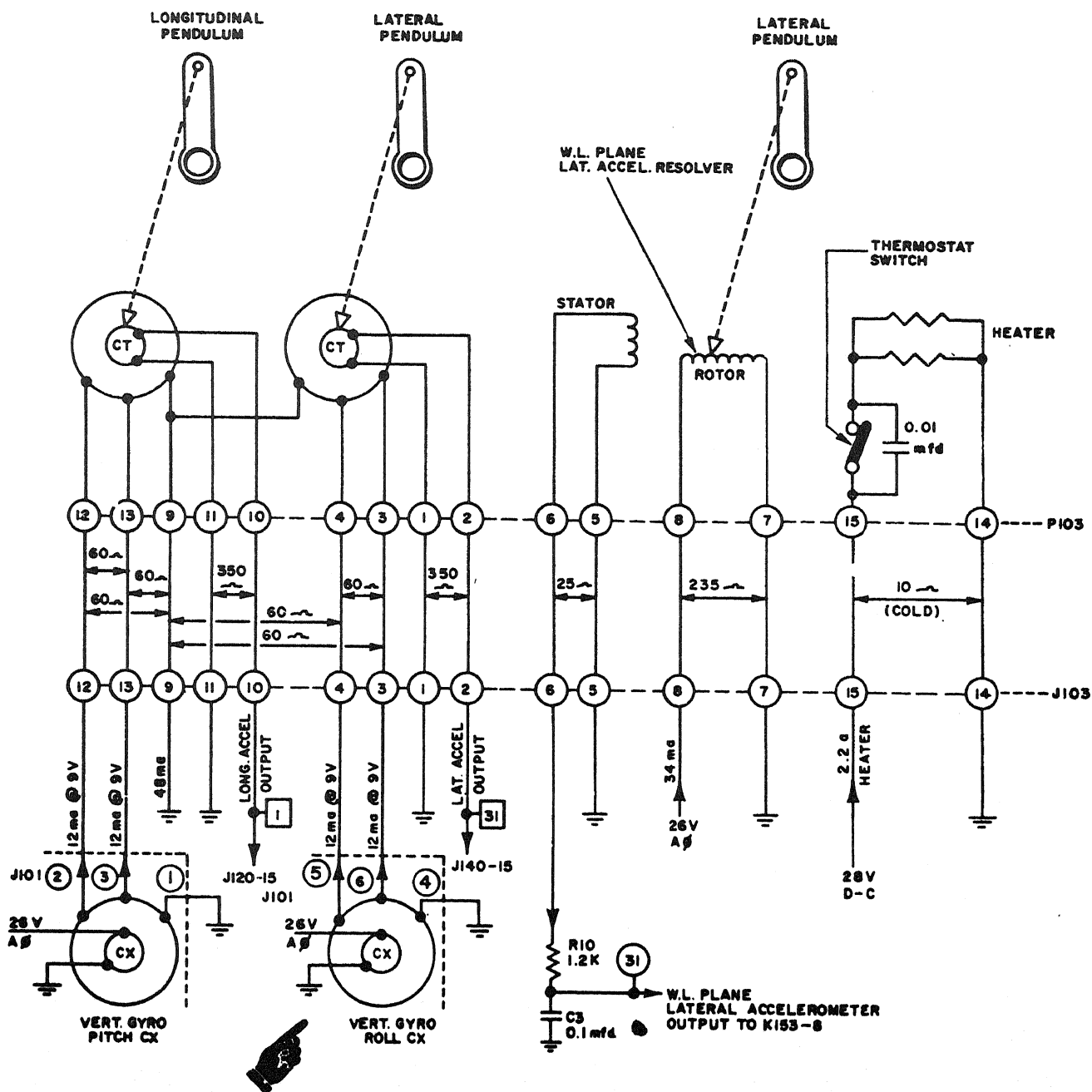
Vertical Gyro



Copilot's



Rate Gyro



	TEST POINT	SENSITIVITY	POLARITY OF OUTPUT
LONGITUDINAL ACCELEROMETER	J157-1	360 mv/deg = 640 mv/ft/sec/sec	ACCELERATING TO REAR -AG ACCELERATING TO FORWARD +AG
LATERAL ACCELEROMETER	J157-31	360 mv/deg = 640 mv/ft/sec/sec	ACCELERATING TO LEFT -AG ACCELERATING TO RIGHT +AG
LATERAL W.L. PLANE ACCEL.	J156-31	190 mv/deg = 340 mv/ft/sec/sec	CASE TILTED TO RIGHT -AG CASE TILTED TO LEFT +AG

Accelerometer



TRIM CIRCUITS



NO LOAD SPEED VS. CONTROL
PHASE VOLTAGE AT RATED
(115V) F.P. VOLTAGE

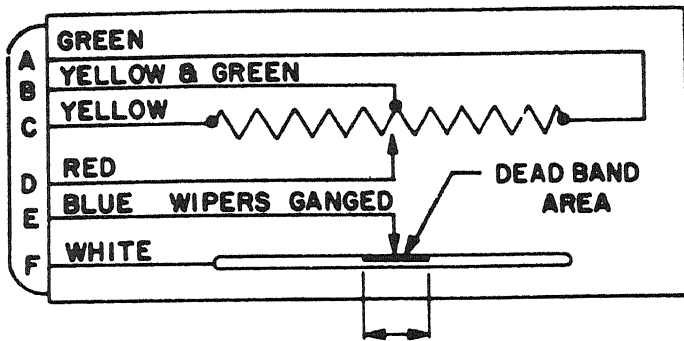


STALL TORQUE VS. CONTROL PHASE VOLTAGE AT RATED (115) F.P. VOLTAGE



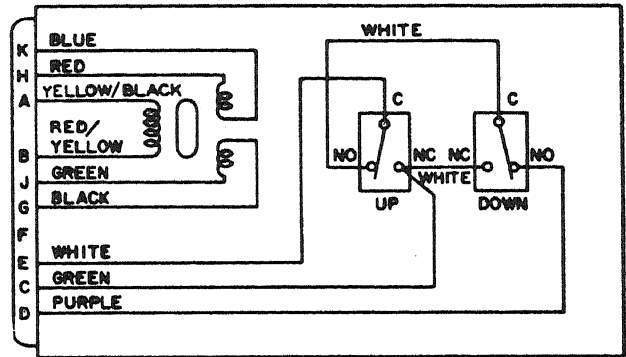
**TORQUE VS. SPEED AT RATED
F.P. (115V) AND VARIABLE C.P. VOLTAGE**

Rotary Trim Actuators



0.075 ± 0.015
SHAFT IN NEUTRAL

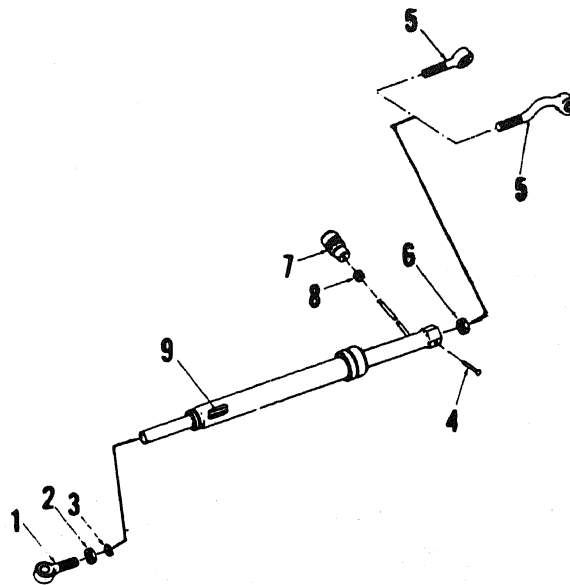
Trim Control Spring Strut Schematic



NOTE

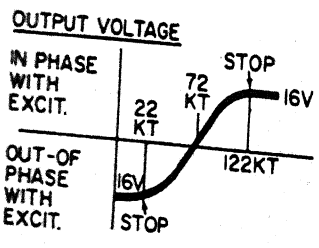
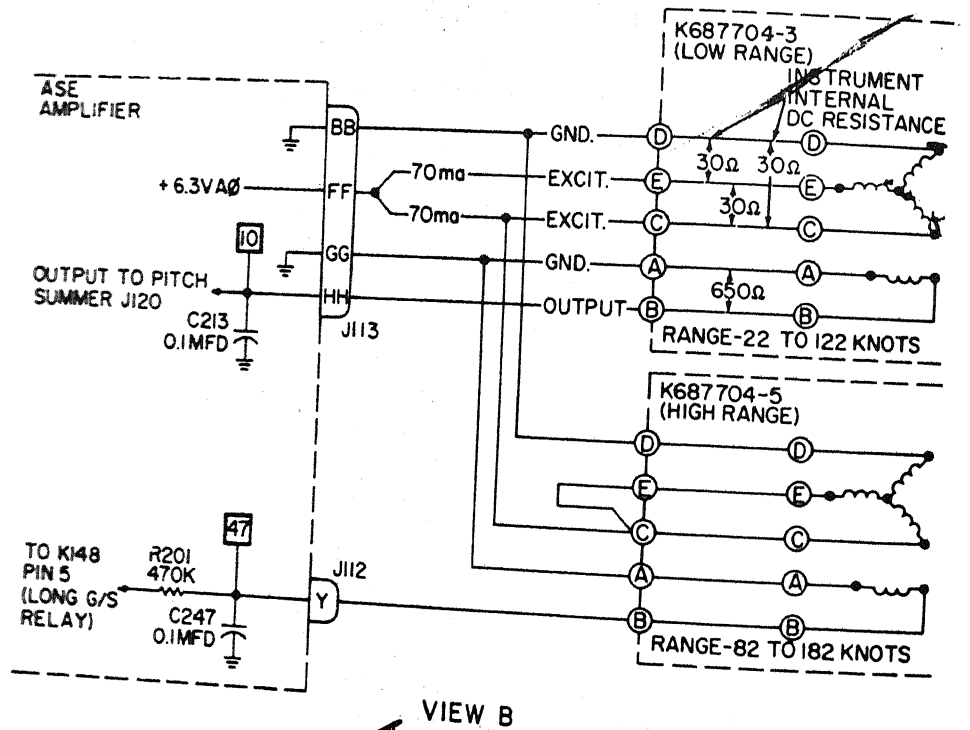
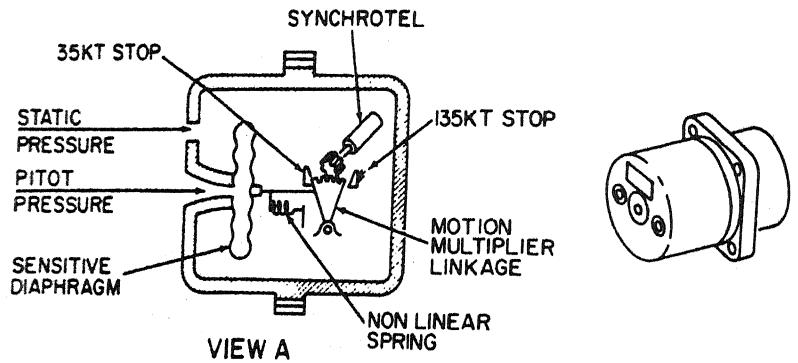
BOTH SWITCHES ARE SHOWN IN STATIC POSITION.
(NO PRESSURE ON COLLECTIVE STICK.)

Collective Control Force Rod Schematic

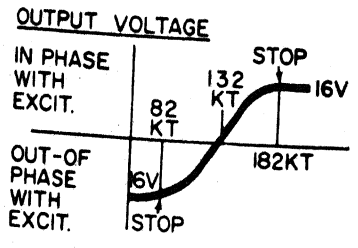


1. Rodend
2. Nut
3. Key washer
4. Rivet
5. Rodend
6. Nut
7. Connector plug
8. Grommet
9. Potentiometer

Trim Control Spring Strut Assembly



VIEW C
LOW RANGE
(K687704-3)

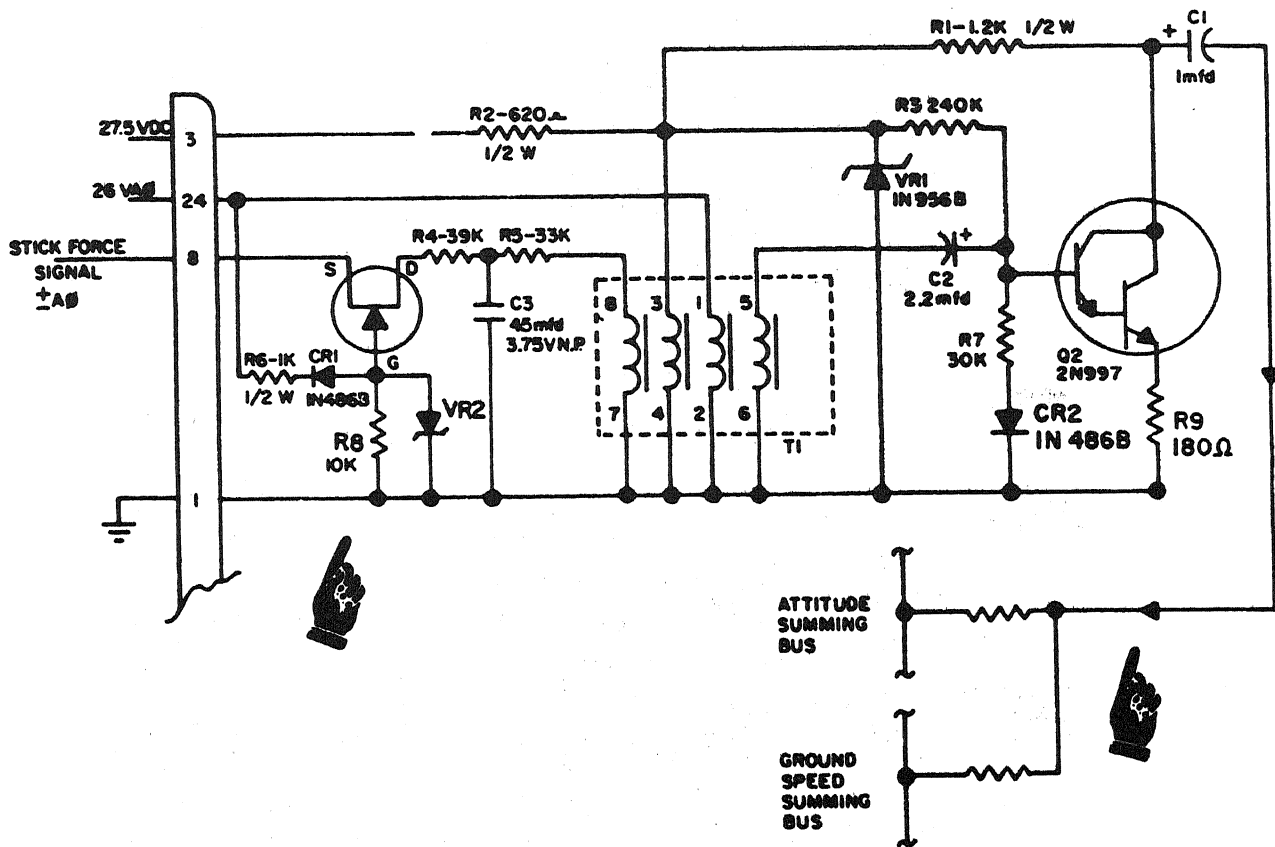


VIEW D
HIGH RANGE
(K687704-5)

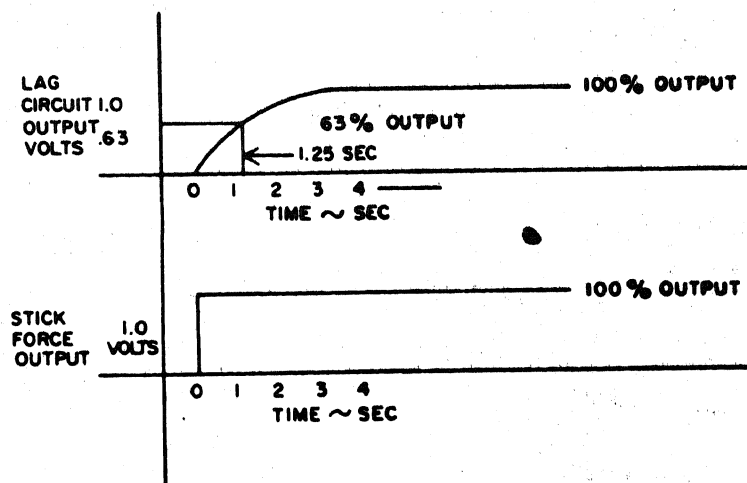
TEST POINT ON AMPLIFIER TEST RECEPTACLE J157

AFTER AFC181 (101 ROTOR)

Airspeed Synchrotel Transmitter



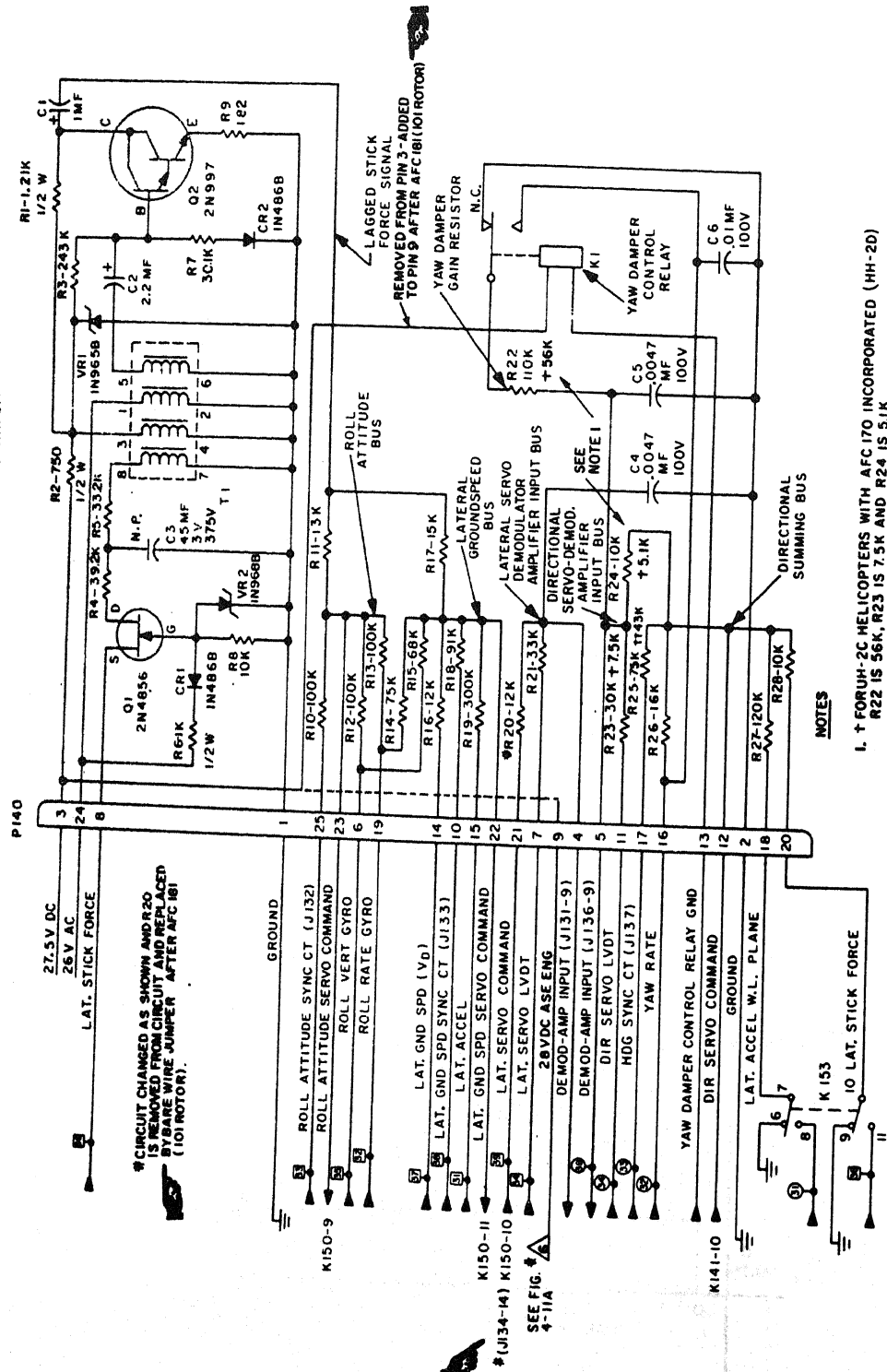
VIEW A



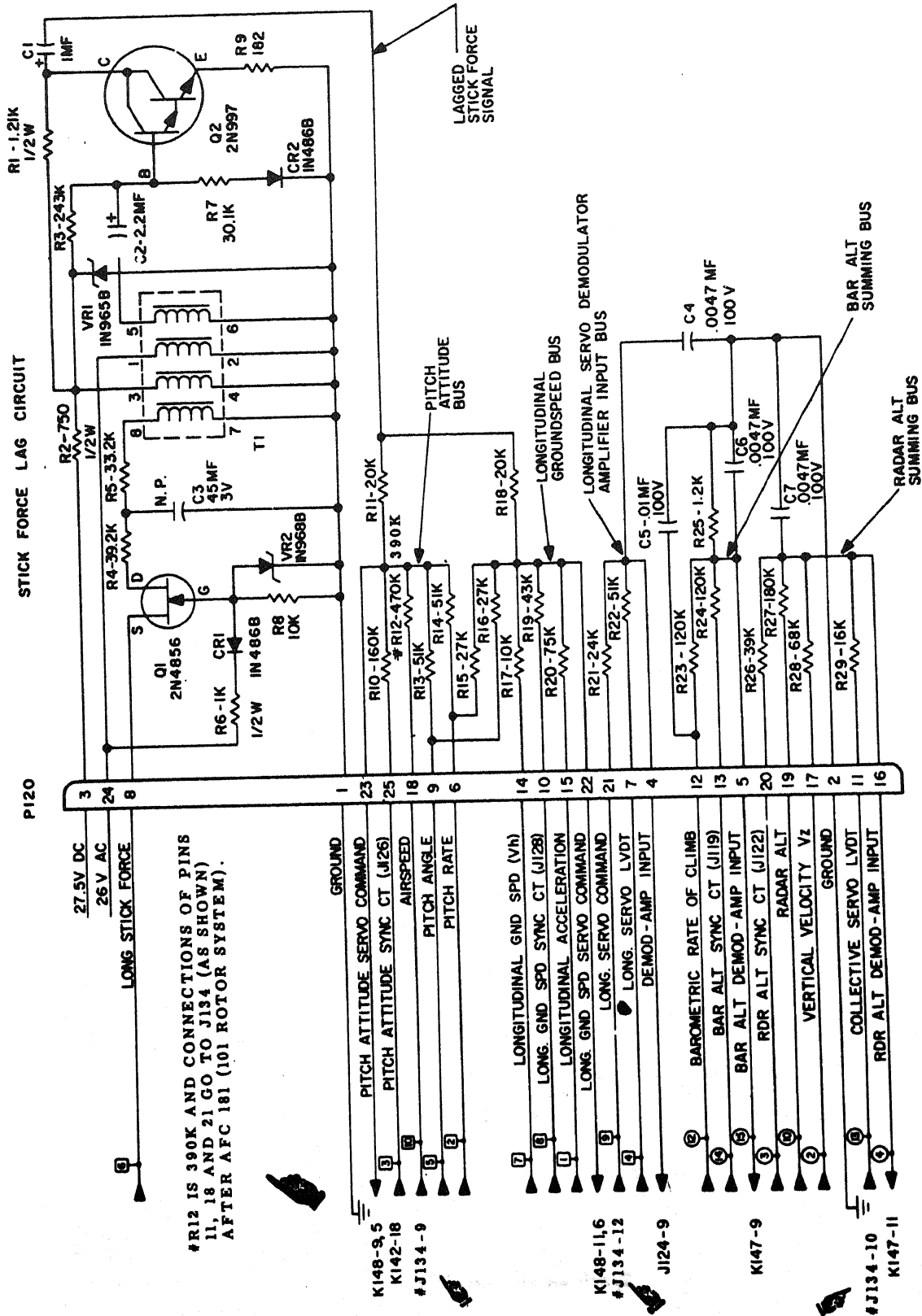
VIEW B

Stick Force Non-Linearity Circuit

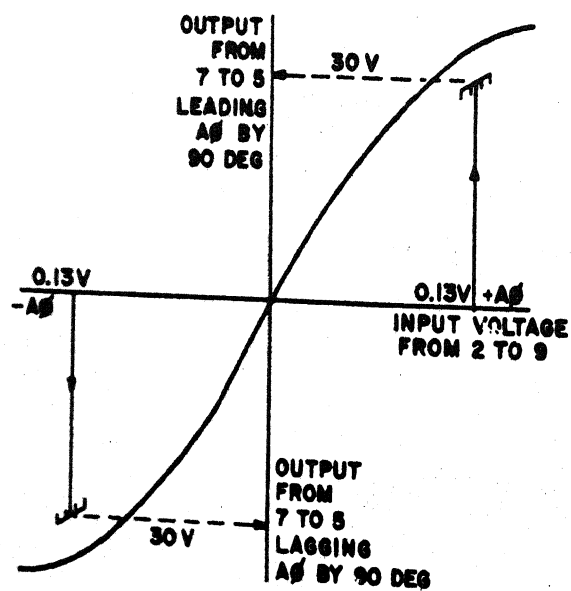
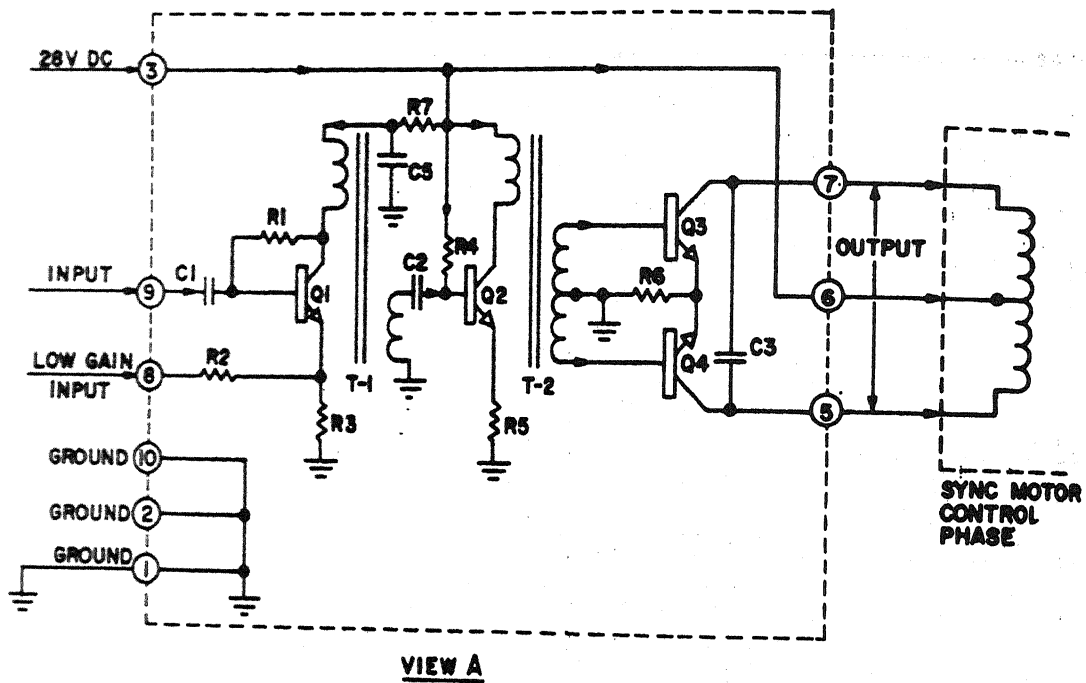
STICK FORCE LAG CIRCUIT



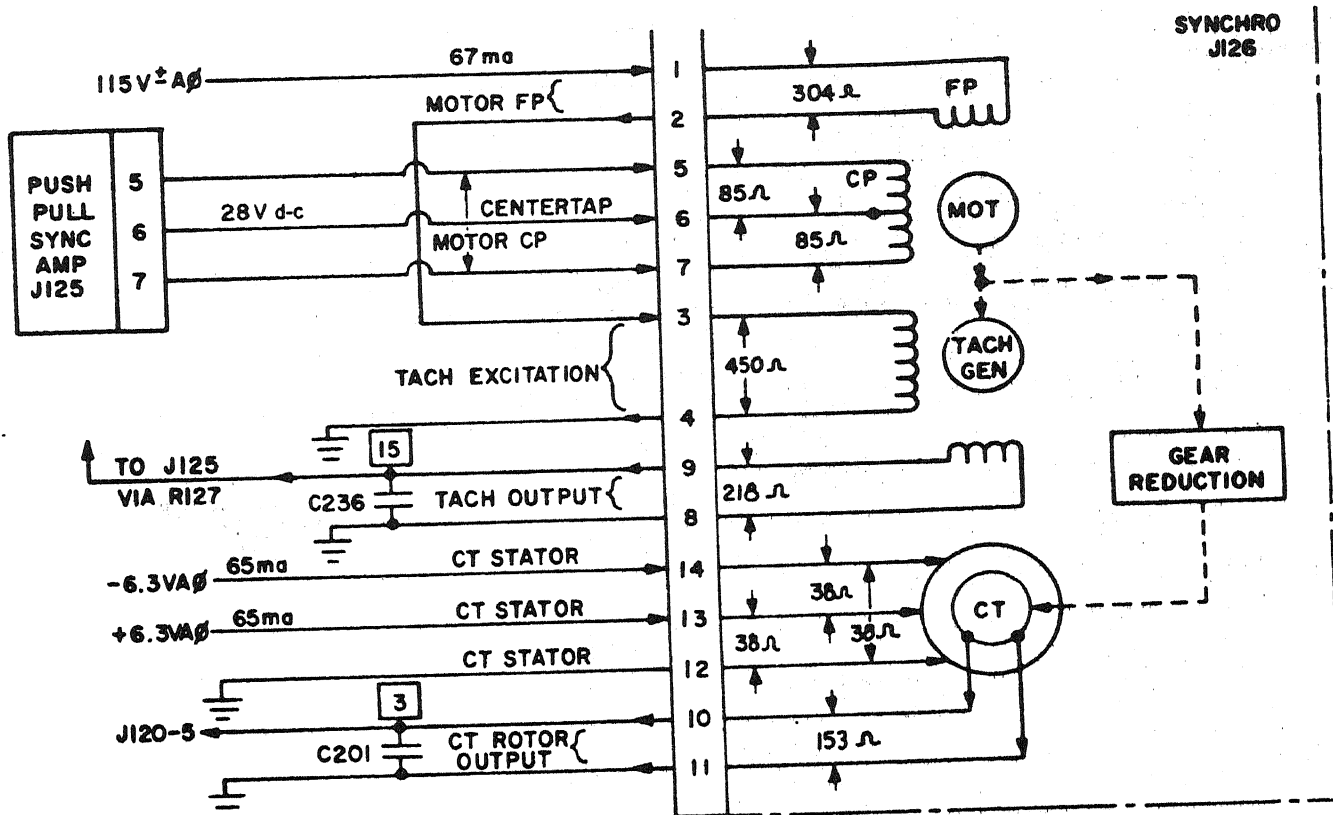
Summing Network (Lateral - Directional) J140



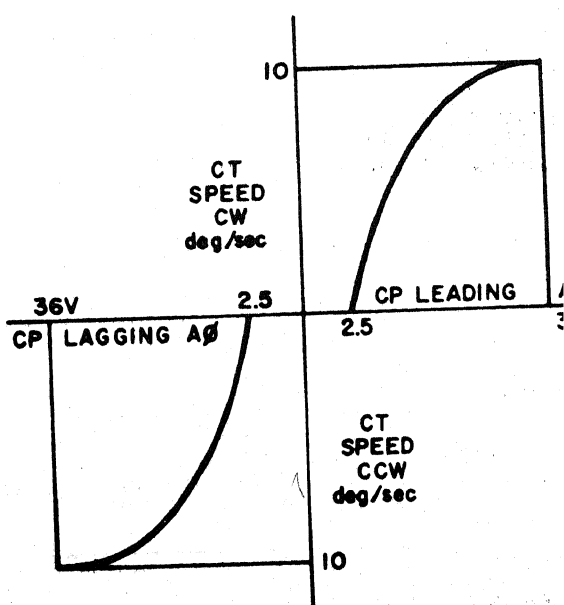
Summing Network (Longitudinal - Collective) J120



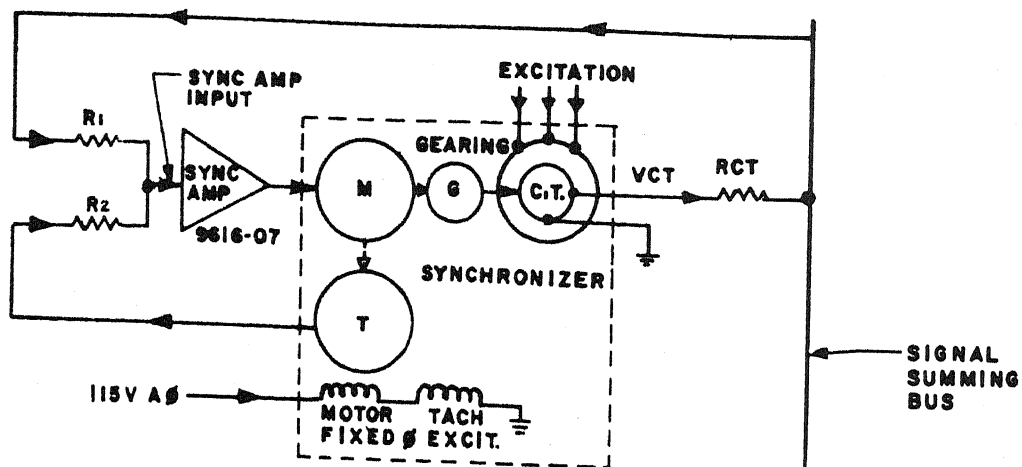
Synchronizer Amplifier



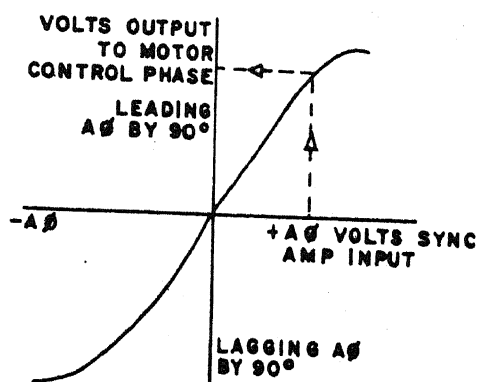
VIEW A (PITCH ATTITUDE SYNCHRONIZER (J126) SHOWN)



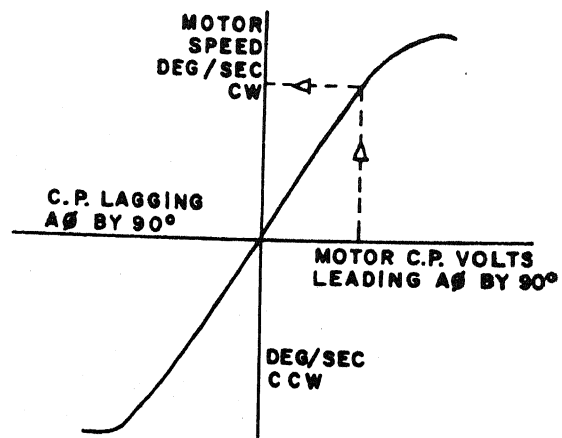
VIEW B



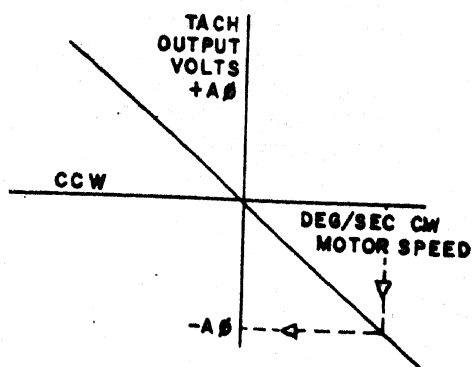
VIEW A



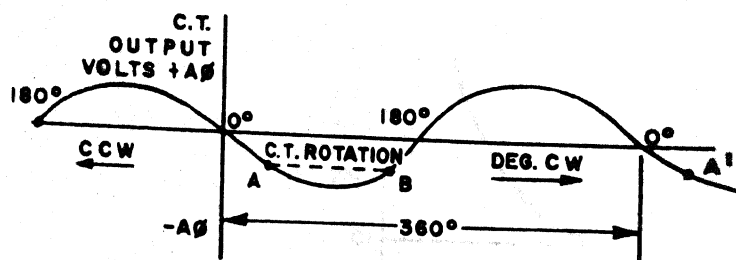
VIEW B



VIEW C

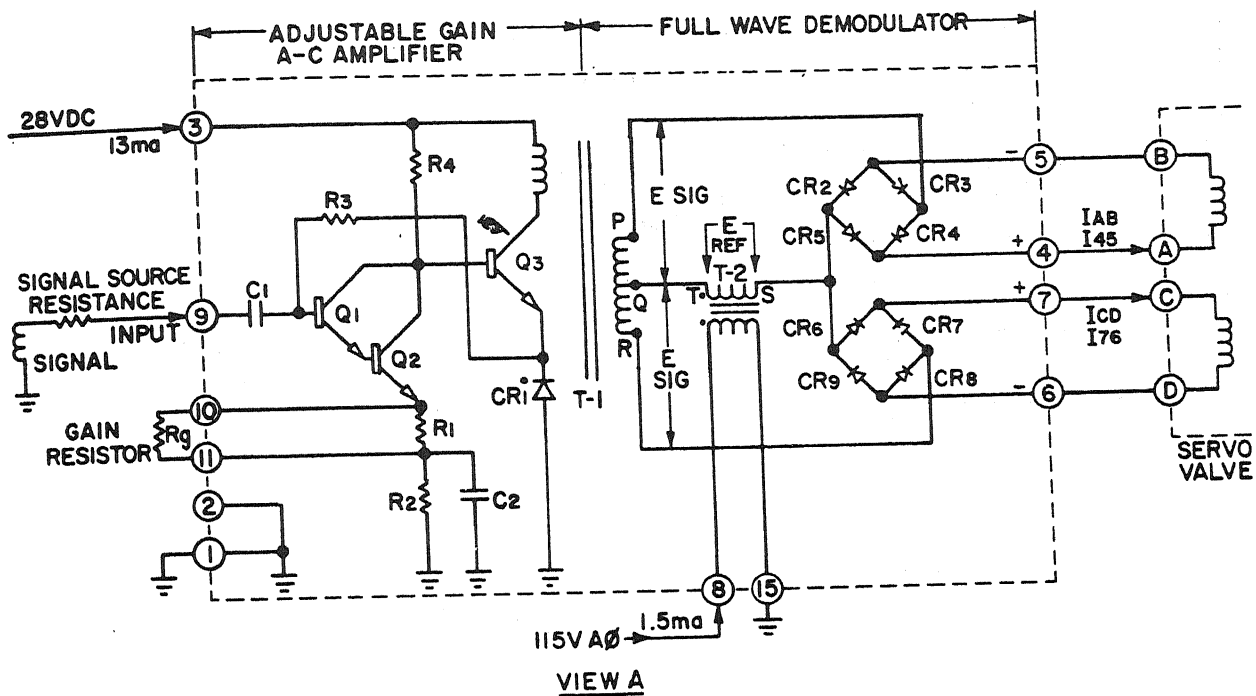


VIEW D

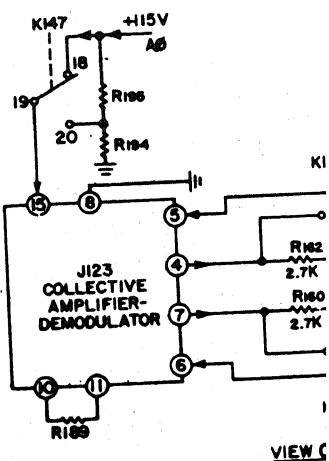
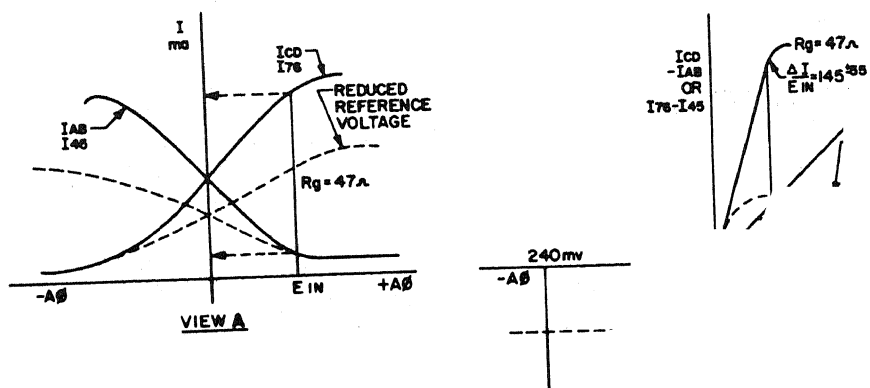


VIEW E

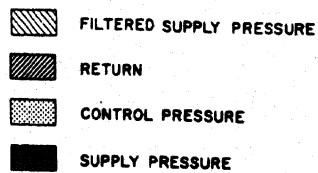
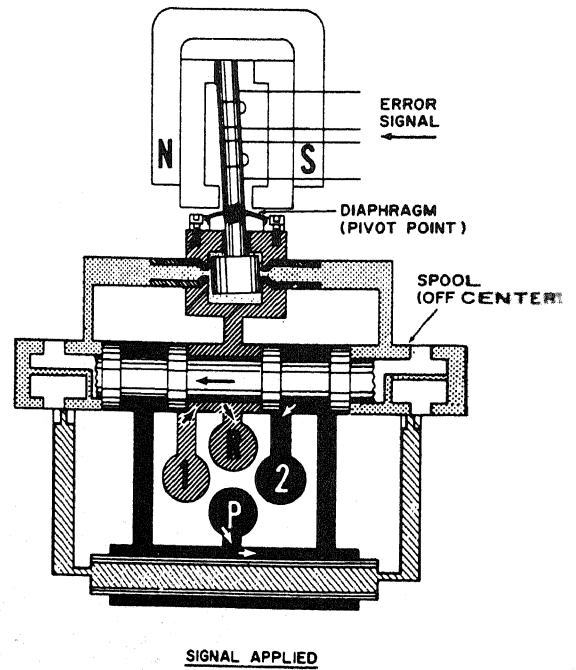
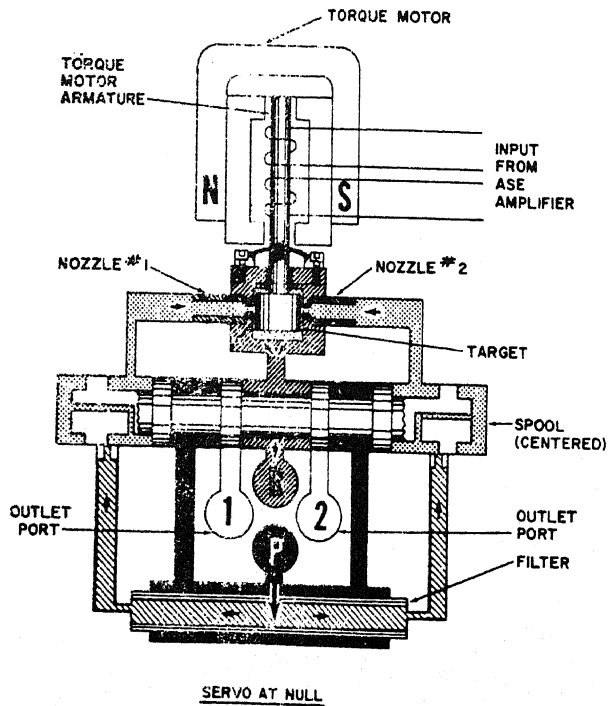
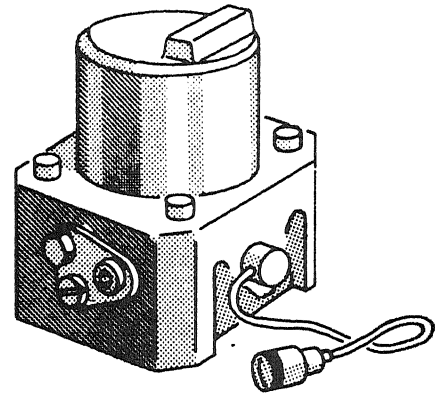
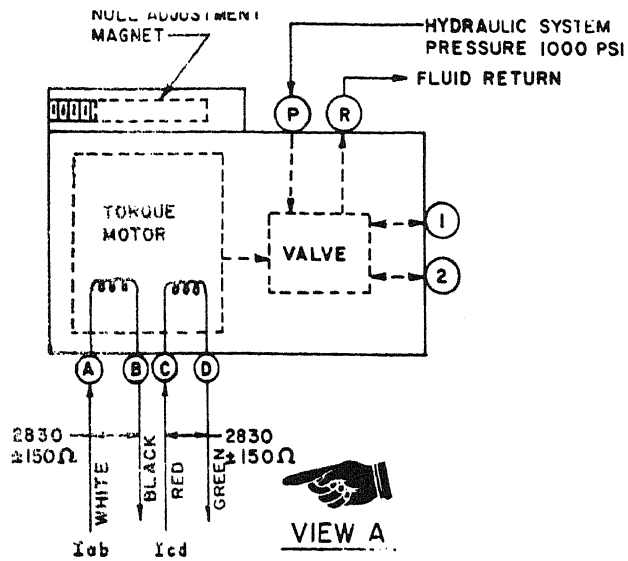
Principles of Synchronization



Demodulator Amplifier Schematic



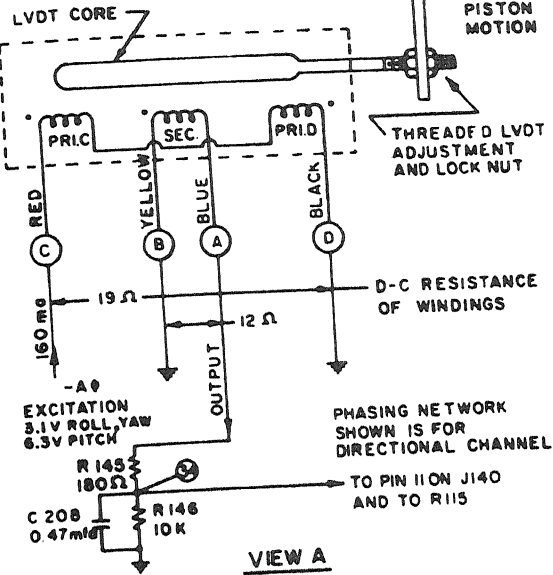
Demodulator



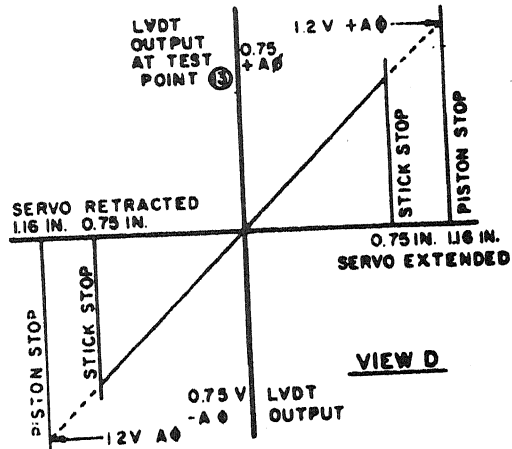
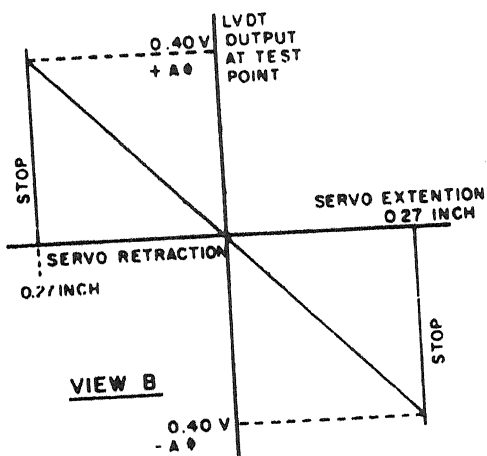
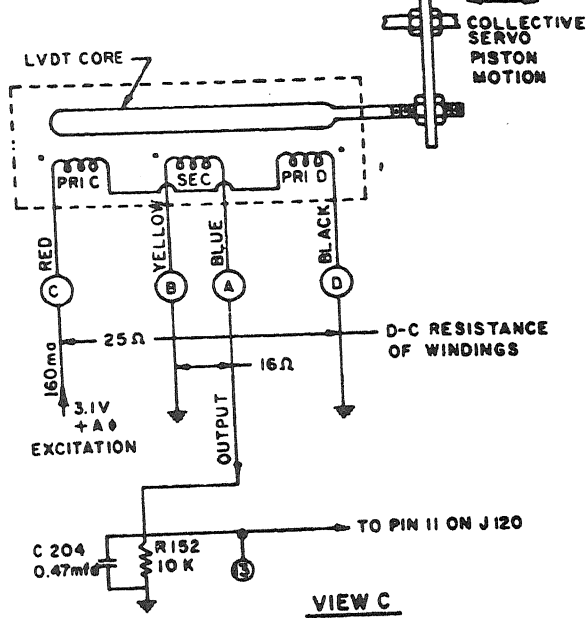
Electro-Hydraulic Servo Valve — Schematic

SERIES CHANNELS

PITCH, ROLL, YAW
PITCH CHANNEL
-6.3 VAØ

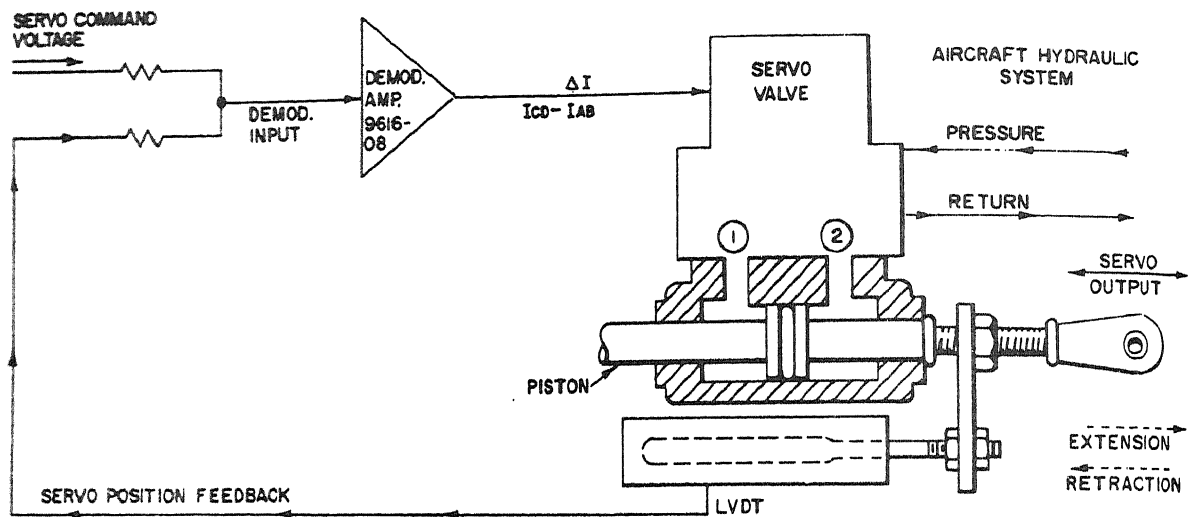


CHANNEL TYPE

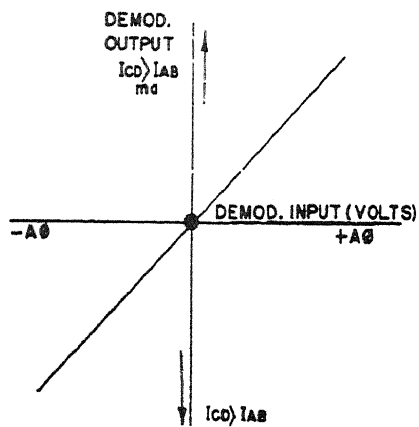


MAX STROKE FOR 5% LINEARITY
INSTALLED MAX STROKE
SENSITIVITY WITH PHASING NETWORK 400 cps EXCITATION @ 6.3V, 400 cps EXCITATION
QUADRATURE AND HARMONICS AT NULL @ 3.1 V, 400 cps EXCITATION
PRIMARY D-C RESISTANCE
SECONDARY D-C RESISTANCE
EXCITATION CURRENT @ 3.1 V, 400 cps EXCITATION

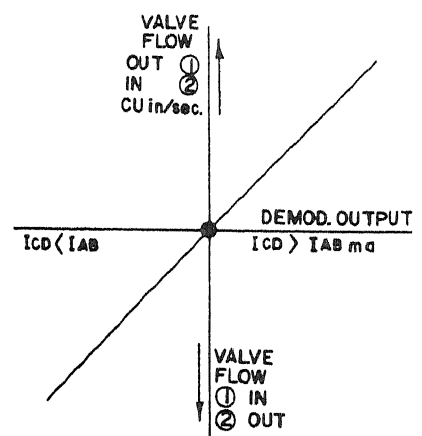
LVDT Line



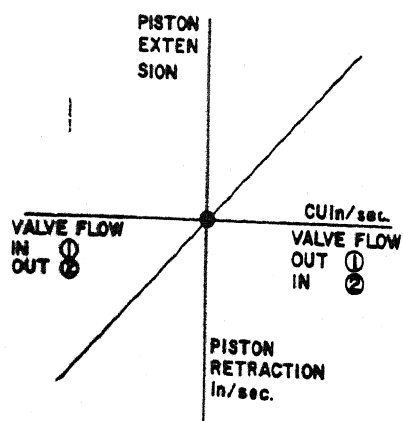
VIEW A



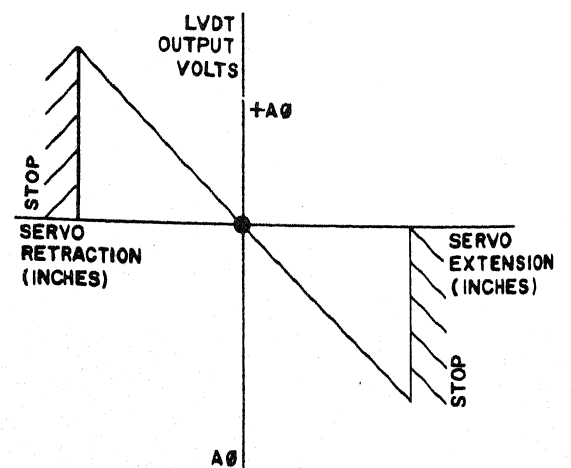
VIEW B



VIEW C

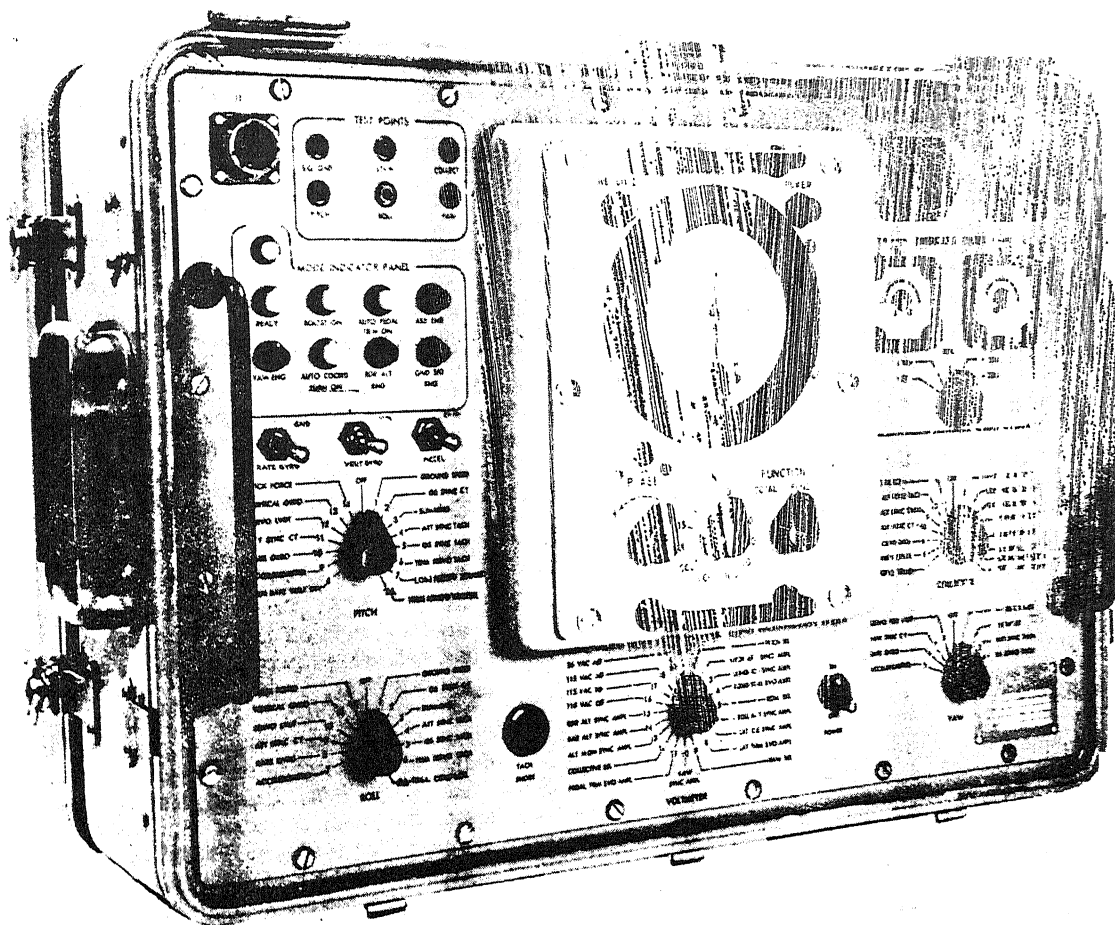


VIEW D

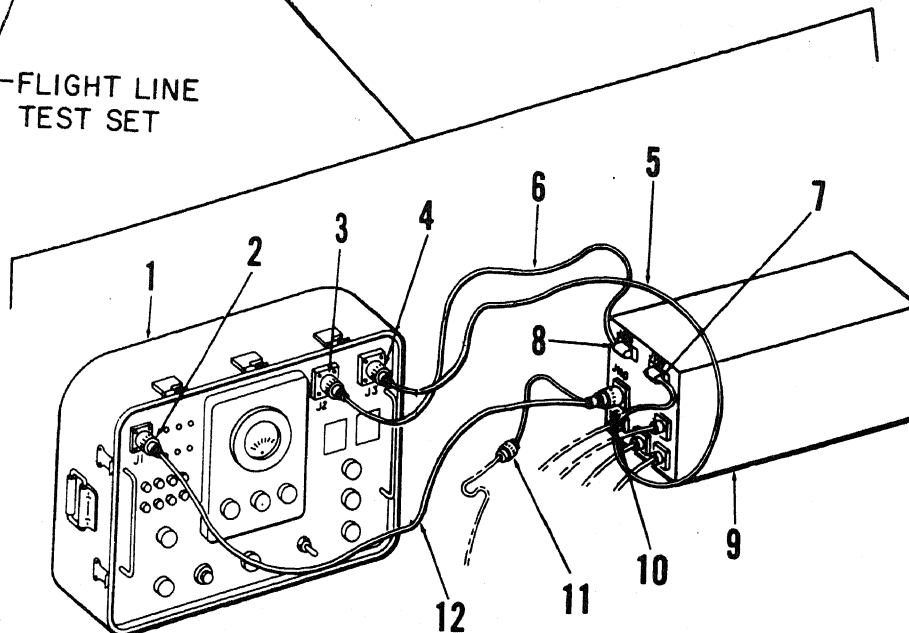
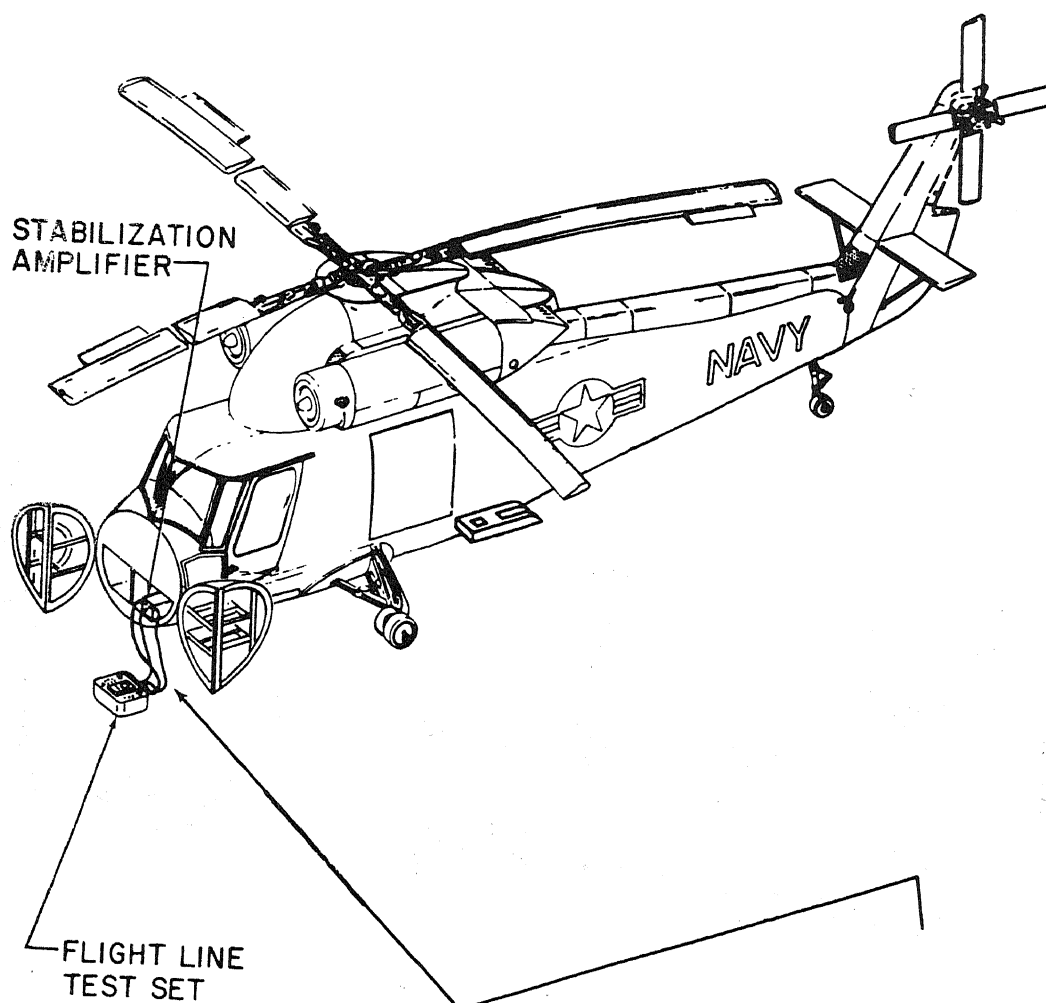


VIEW E

Principles of Operation — ASE Electro-Hydraulic Servo Valve

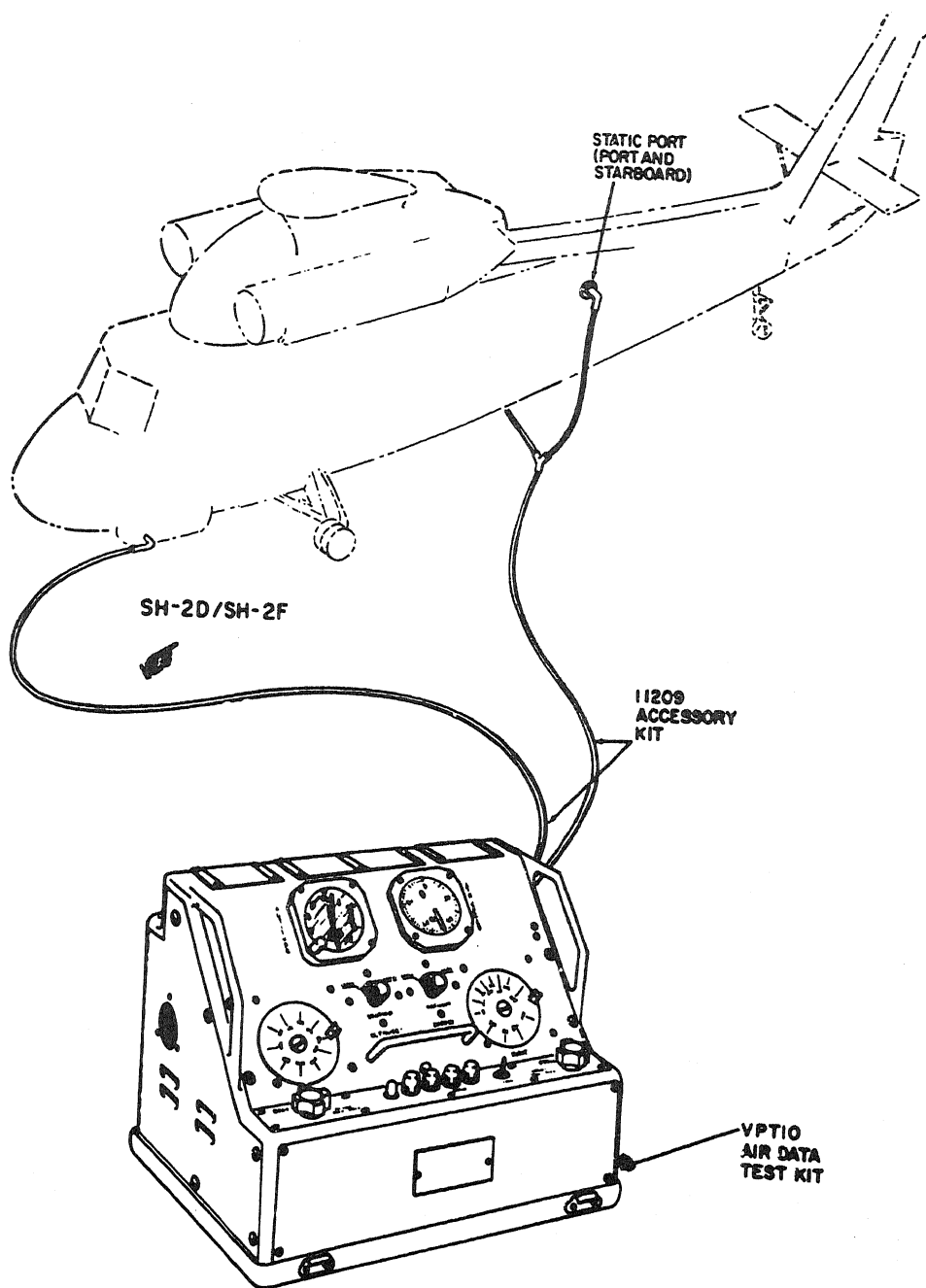


Flight Line Test Set



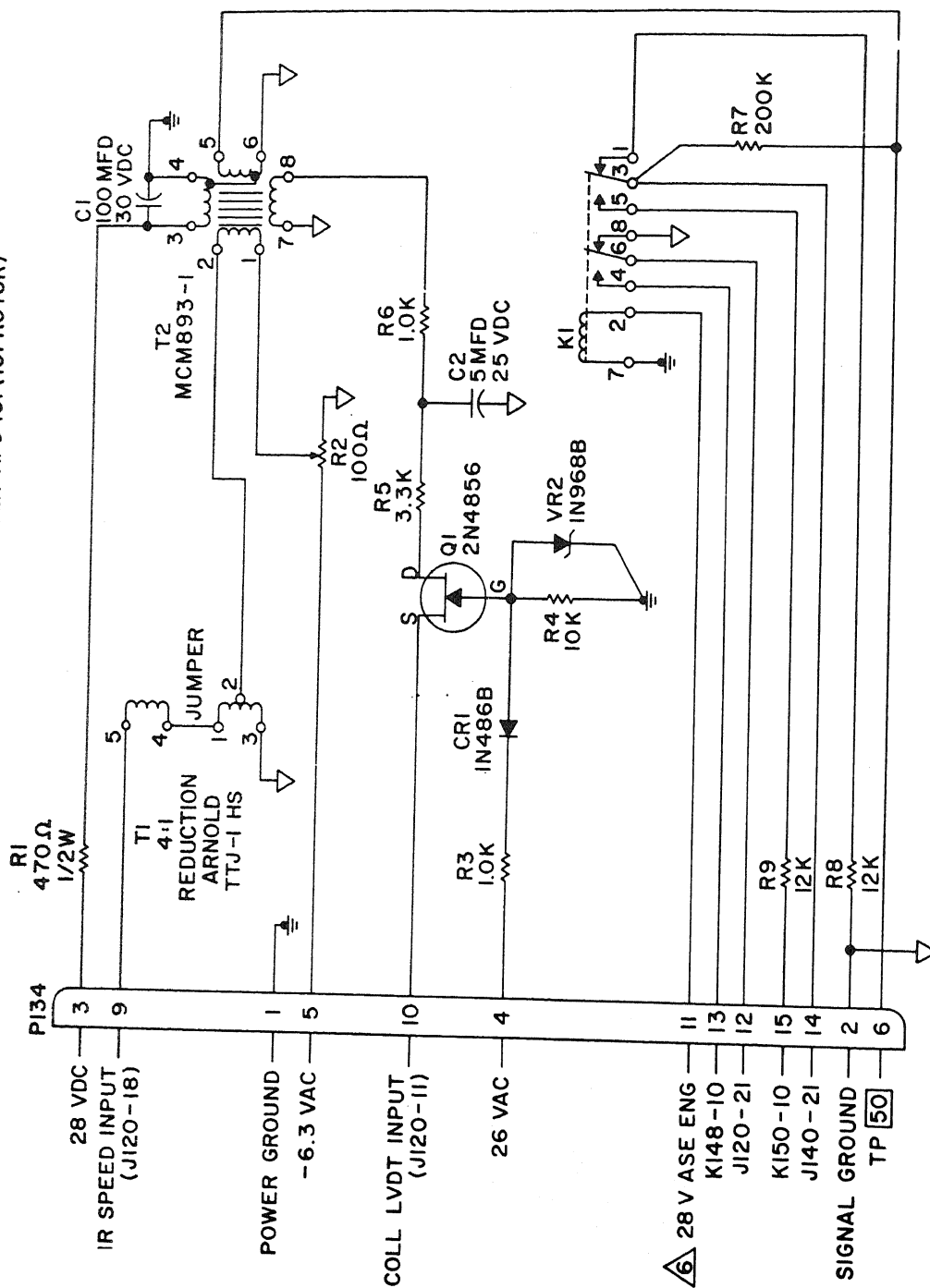
- | | |
|------------------------------------|-------------------------------------|
| 1. Flight line test set | 7. Connector, P157 |
| 2. Connector, P1 | 8. Connector, P156 |
| 3. Connector, P2 | 9. Stabilization amplifier |
| 4. Connector, P3 | 10. Connector, P110B |
| 5. Cable assembly, P/N K604605-103 | 11. Connector, P110A |
| 6. Cable assembly, P/N K604605-101 | 12. Cable assembly, P/N K604605-105 |

Flight Line Test Set Connected to Amplifier

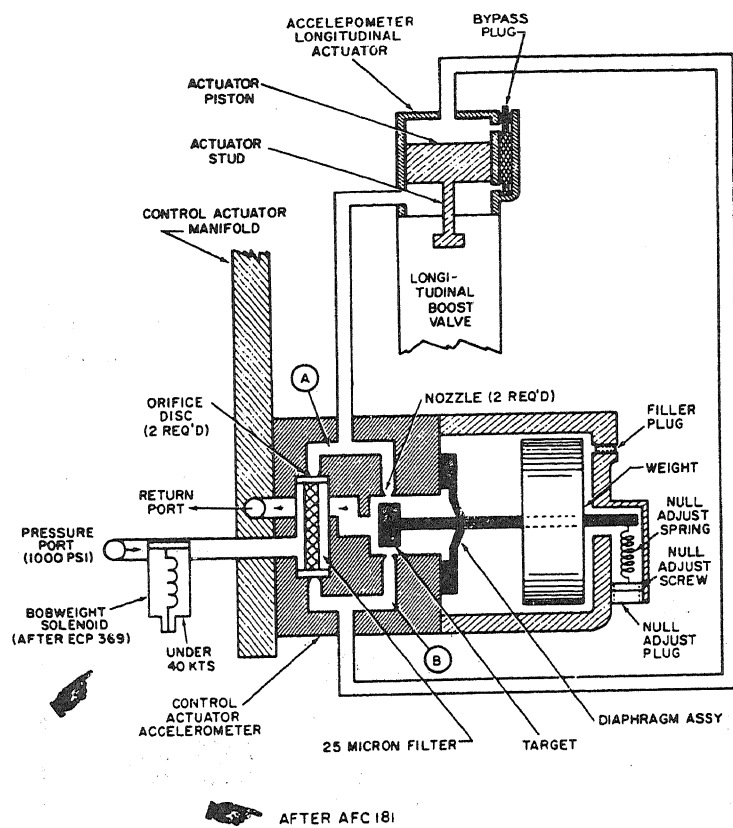


Air Data Test Set

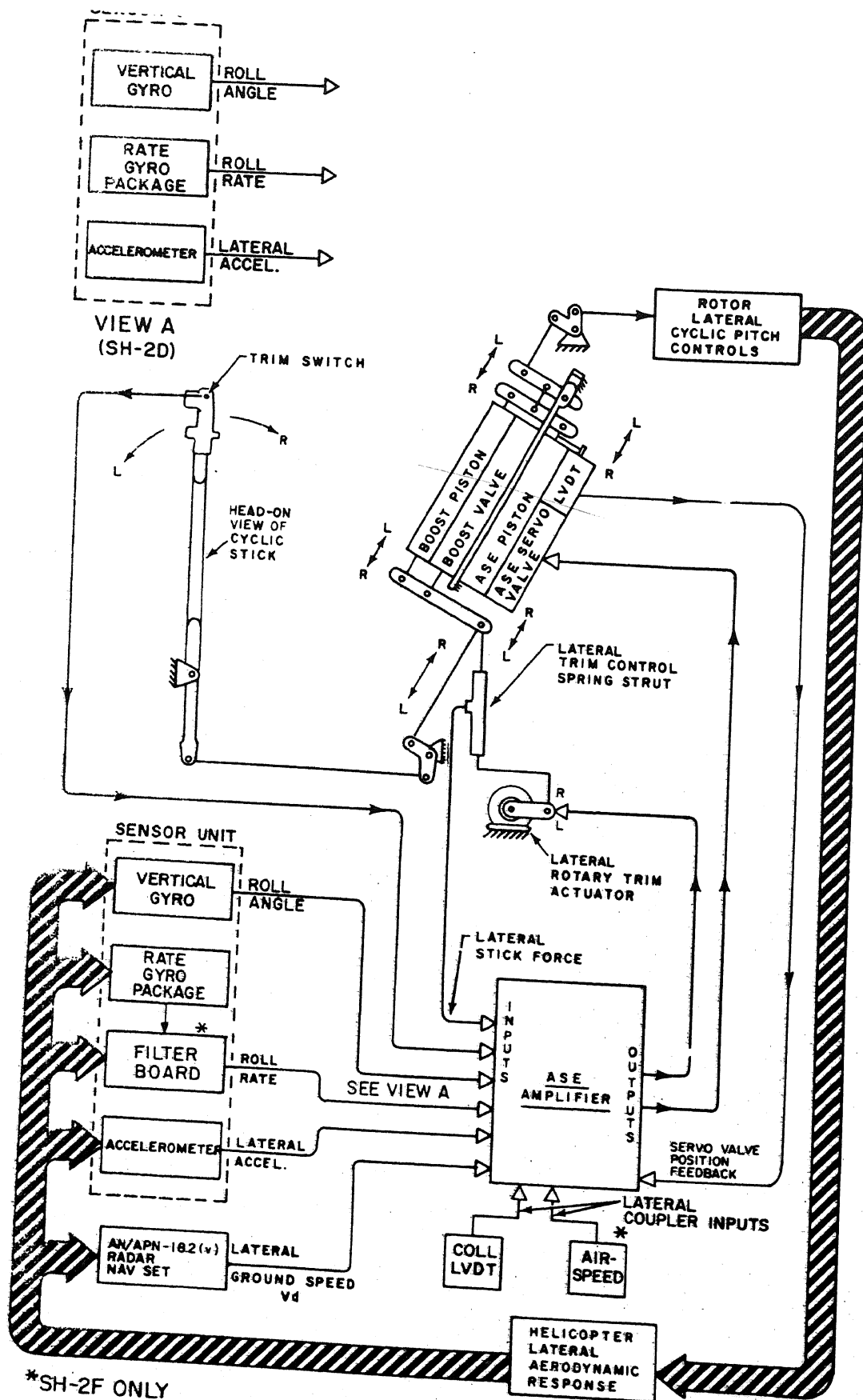
INSTALLED IN AMPLIFIER AFTER AFC 181 (101 ROTOR)



Lateral Collective Coupler Network J134

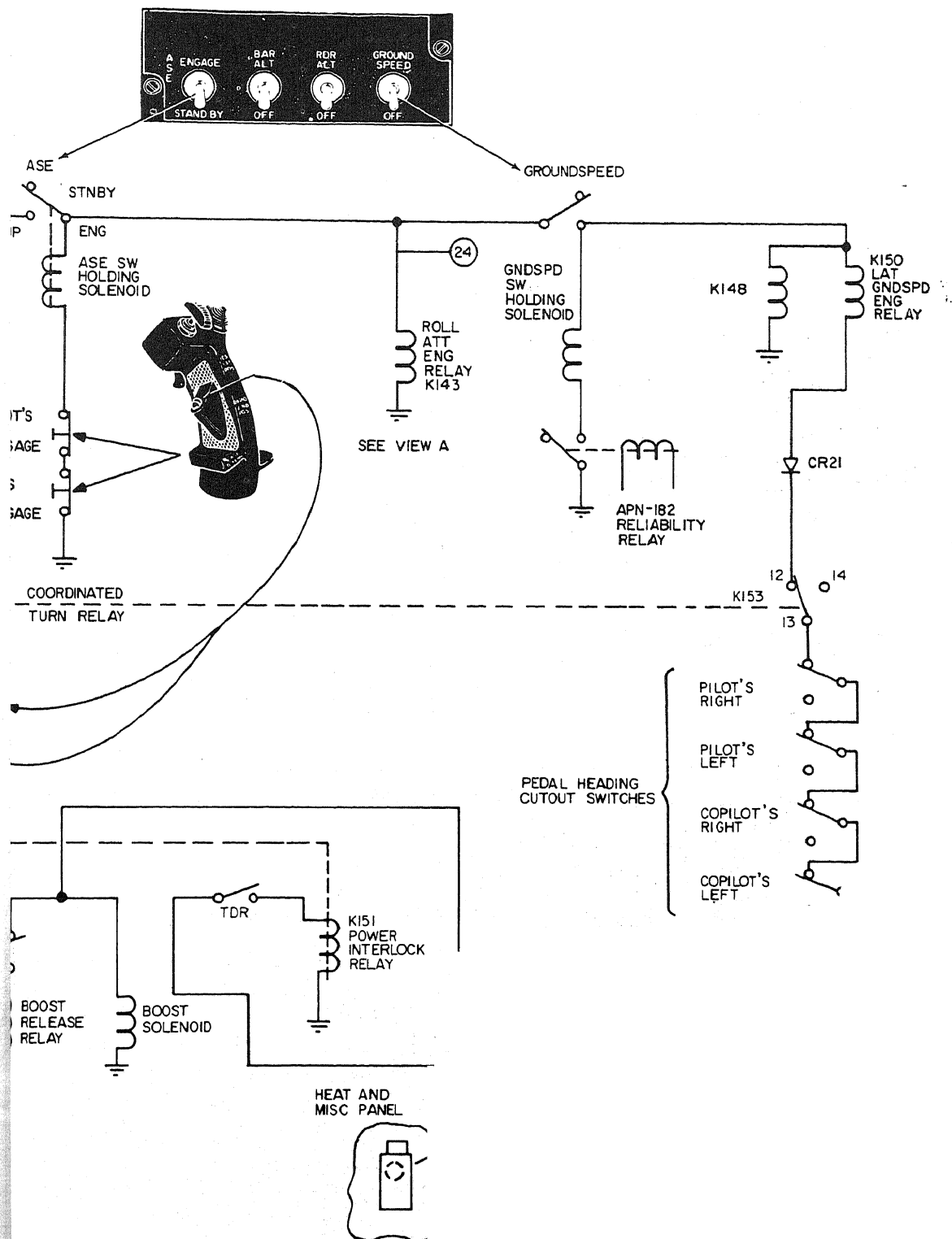


Control Actuator Accelerometer and Bobweight - Flow Diagram



Lateral Control Schematic and Roll Axis Block Diagram

ROLL CHANNEL CONTROL SWITCHING DIAGRAM



I TITLE: OPERATIONAL "QUICK-CHECK" OF THE ROLL CHANNEL OF ASE

II TOOLS, EQUIPMENT AND MATERIAL:

1. HH-2D Trainer, Section 1, Part No. K603903-5
2. Power Cart, Part No. K603923-1
3. ASE flight line test set, Part No. K604605-6
4. ASE Manual Maintenance Instructions, NA 01-260HCA-2-5
5. AE toolbox

FOR TRAINING PURPOSES ONLY

NOTE: To be used in conjunction with latest MMI test procedures.

III PROCEDURE:

1. ASE in "Standby and Warmup" mode
 - a. Run trim left and right. Stick should follow.
 - b. Monitoring TP 39 of J157 on .3 volt range, watch for bus voltage increase and decrease to zero while tilting sensor unit to the right 10° and holding. (Checks roll attitude sync loop)
 - c. Relevel sensor unit. (Check that lateral coupler relay prevents M1 and M2 movement while moving sensor)
2. ASE engaged mode (ASE engage light ON, meters nulled)
 - a. Tilt sensor unit to the left approximately 10° and hold: M1 increase and M2 decrease, and hold this way. (Lateral coupler K1 now engaged)

NOTE: This checks roll attitude mode with ASE engaged
 - b. Leave the demodulator meters split
3. Groundspeed engaged mode
 - a. Engage G/S switch and the meters should null out (Checks groundspeed sync loop)
 - b. Tilt sensor unit to right and M2 should increase as M1 decreases, and hold this way.
 - c. With the meters split, disengage groundspeed; meters should null out. (Checks roll attitude sync loop with G/S engaged)
 - d. Disengage ASE and continue

4. Checking servo valve, ASE piston movement and LVDT (requires hydraulics)
 - a. Apply hydraulic power
 - b. Watching demodulator meters, engage ASE; the meters should not split. If meters do split
 - (1) Check LVDT adjustment
 - (2) Ensure no output from J134 present
 - (3) Check servo valve adjustment
 - c. With nulled meters, tilting sensor unit should make ASE piston move and be immediately recentered by LVDT output.
-

- I TITLE: Operational Check of Roll Channel
- II Tools, Equipment and Material
 1. SH-2F flight control panel, section 1, K603903-5
 2. Power cart, K603023-3
 3. ASE flight line test set, K604605-6
 4. Manual Maintenance Instruction, NAVAIR 01-260HCO-2-5
- III PROCEDURE:
 1. Flight line test set hook-up
 - a. Insure that the ASE flight line test set is connected as required by paragraph 1-62, 1 through 2n
 2. System check
 - a. Refer to table 1-1, page 1-28, and complete test 1-7

CAUTION

Always insure that voltmeter range is at 300 during all switch changes, then reduce to proper range for voltage readings

NOTE

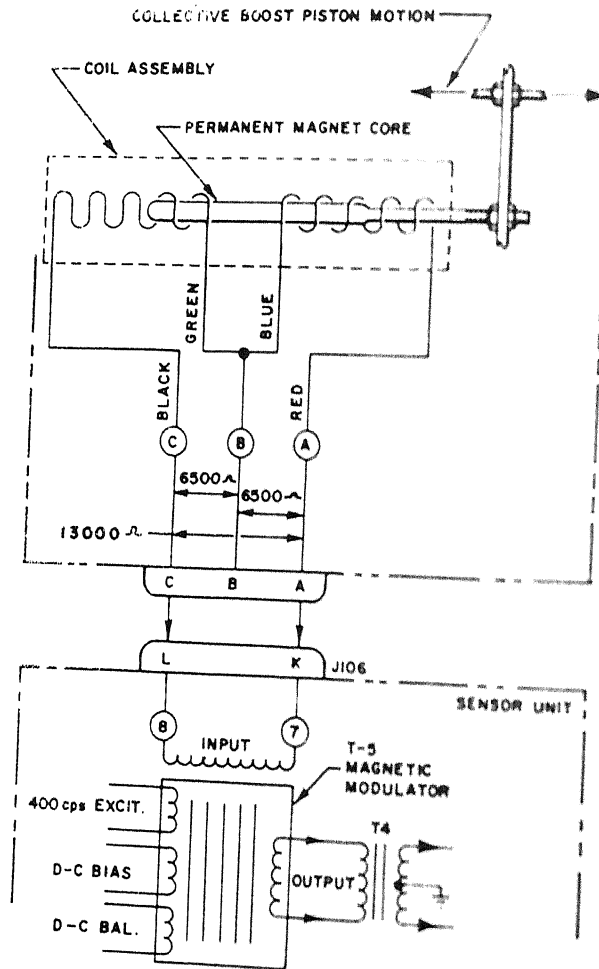
Allow approximately 30MV deviation due to system noise. Plus and minus readings may NOT have equal values due to noise. Variance in reading up to 50% are acceptable

- b. Refer to paragraph 1-67, page 1-33, and comply

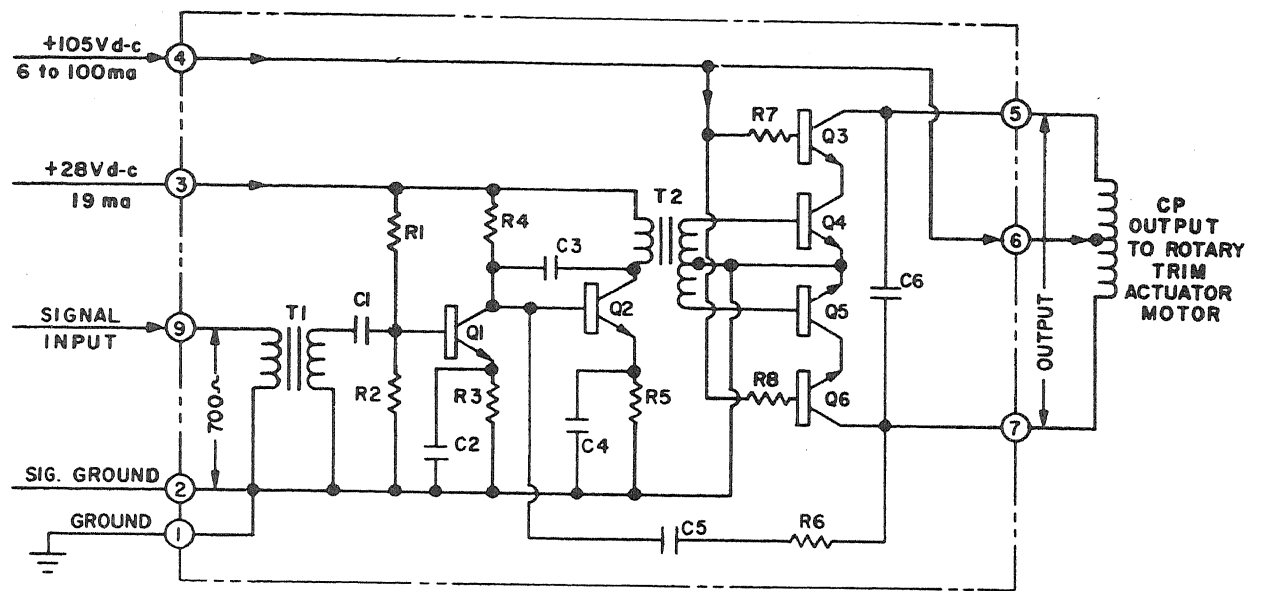
NOTE

The column labeled "checking for" can be used to pinpoint location of signal under test on the ASE system schematic, figure 1-12, page 1-26.

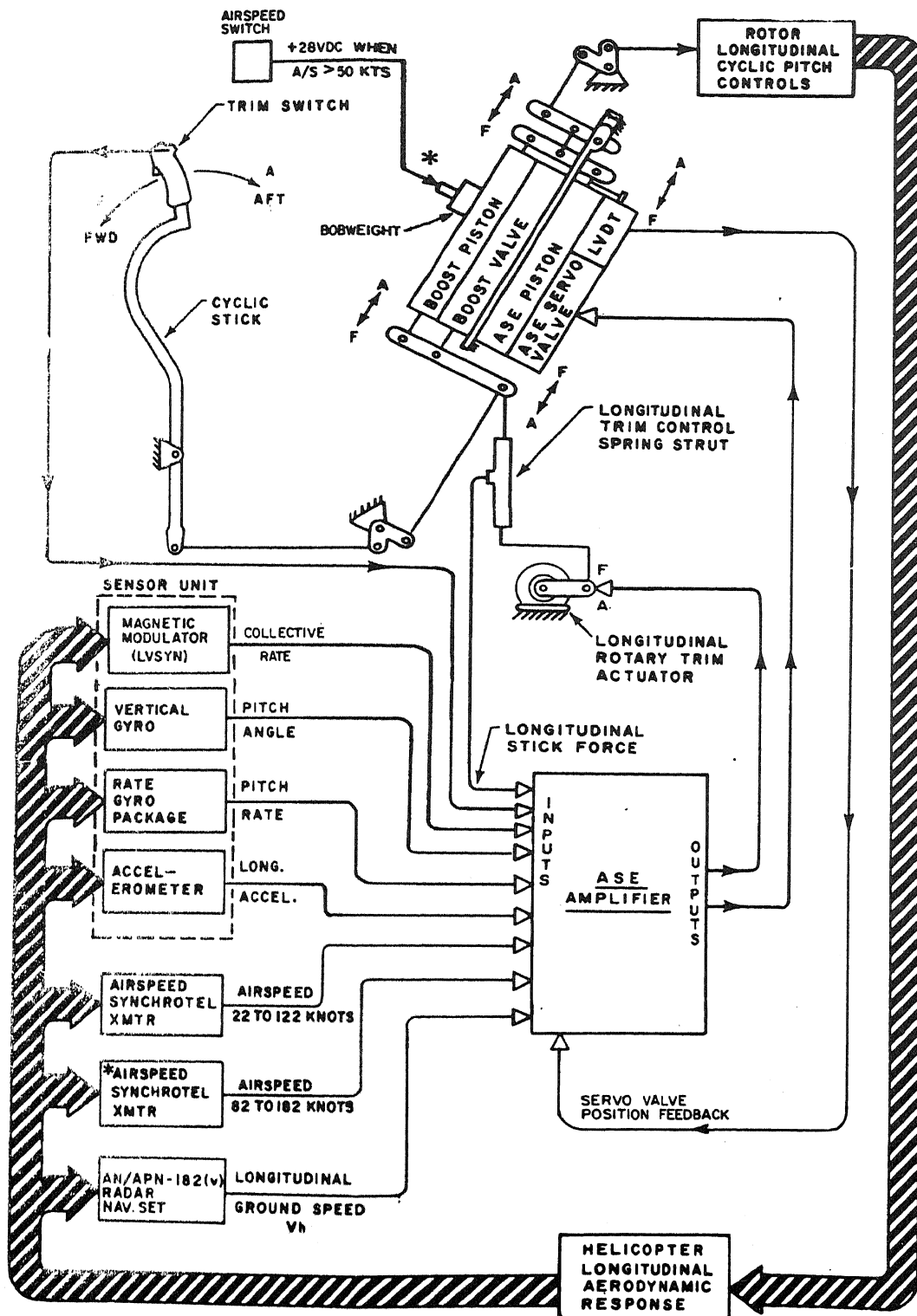
- c. Secure the test set and notify the instruction that you have completed the tests.



LVsyn Transducer — Schematic



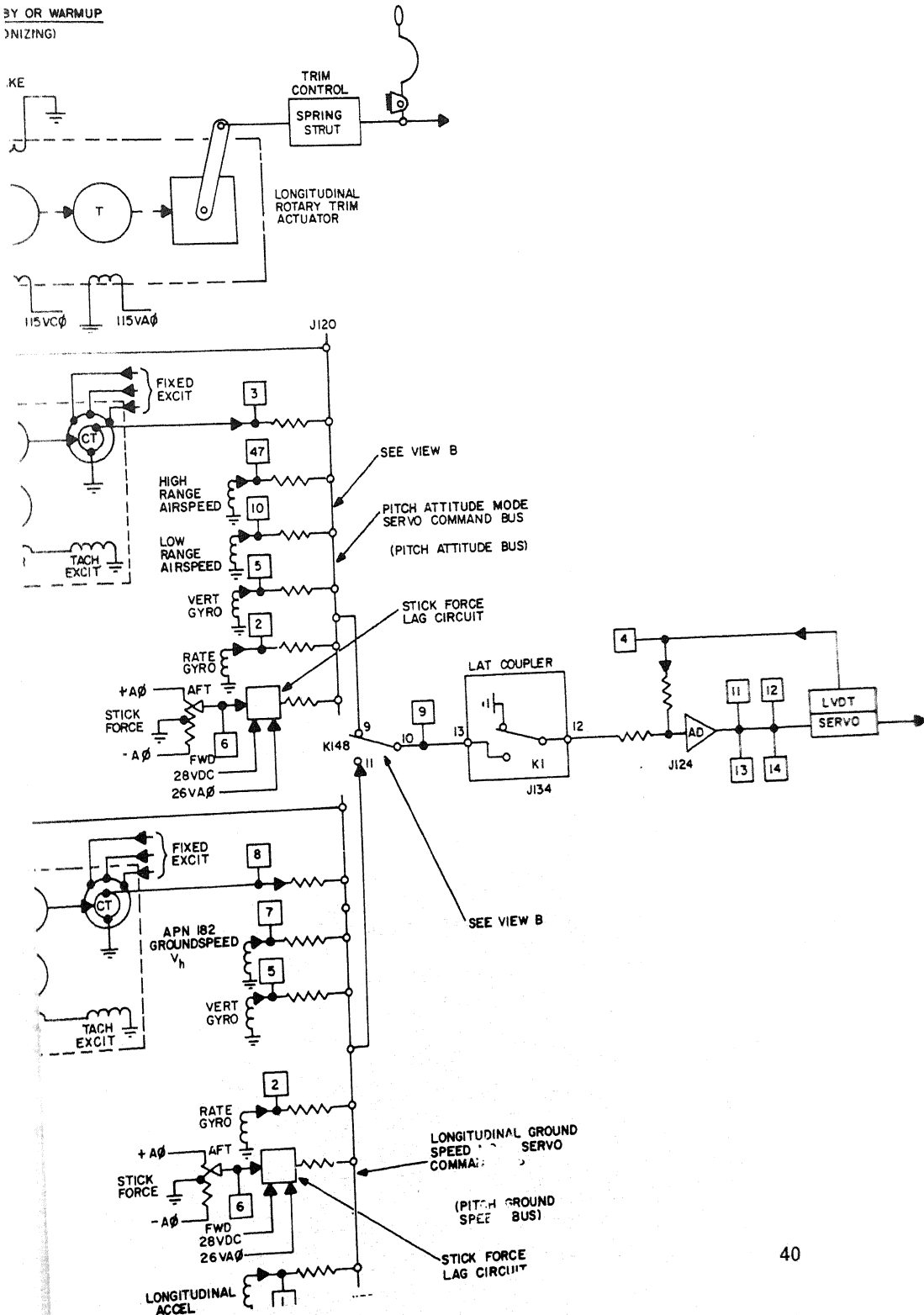
Motor Drive Amplifier



* INSTALLED ON ALL SH-2F HELICOPTERS

Longitudinal Control Schematic and Pitch Axis ASE Block Diagram

BY OR WARMUP
(INITIALIZING)



I TITLE: Operational Check of the Pitch Channel

II TOOLS, EQUIPMENT AND MATERIAL

1. SH-2F flight control panel, section 1, K603903-5
2. Power Cart, K603923-3
3. ASE flight line test set, K604605-6
4. Manual Maintenance Instruction, NAVAIR 01-260HCO -2-5
5. Air data test set, VPT-10HS11633

III PROCEDURE

1. Flight line test set hook-up

- a. Insure that the ASE flight line test set is connected as required by paragraph 1-62, 1 through 2n

2. System Check

- a. Refer to table 1-1, page 1-28, and complete test 1-7

CAUTION

Always insure that voltmeter range is at 300 during all switch changes, then reduce to proper range for voltmeter readings

NOTE

Allow approximately 30MV deviation due to system noise. Plus and minus readings may NOT have equal values due to noise. Variance in reading up to 50% are acceptable

- b. Connect the VPT-10HS, using the accessory kit, in accordance with instructions.

CAUTION

Insure that lines are connected properly. If not, serious damage will occur to ASE equipment and instruments

NOTE

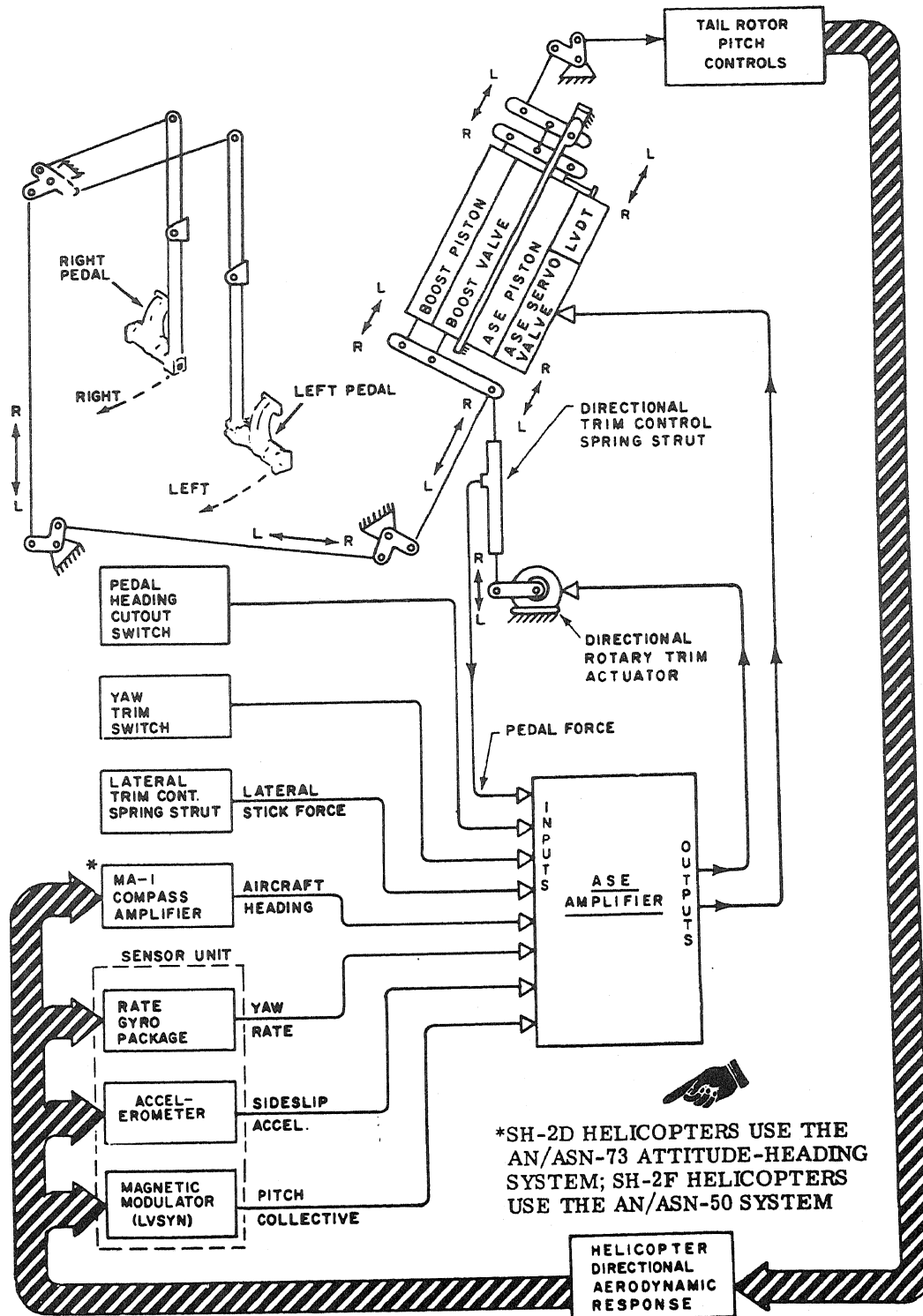
Do not operate VPT-10HS until called for during operational check

- c. Refer to paragraph 1-65, page 1-27, and comply

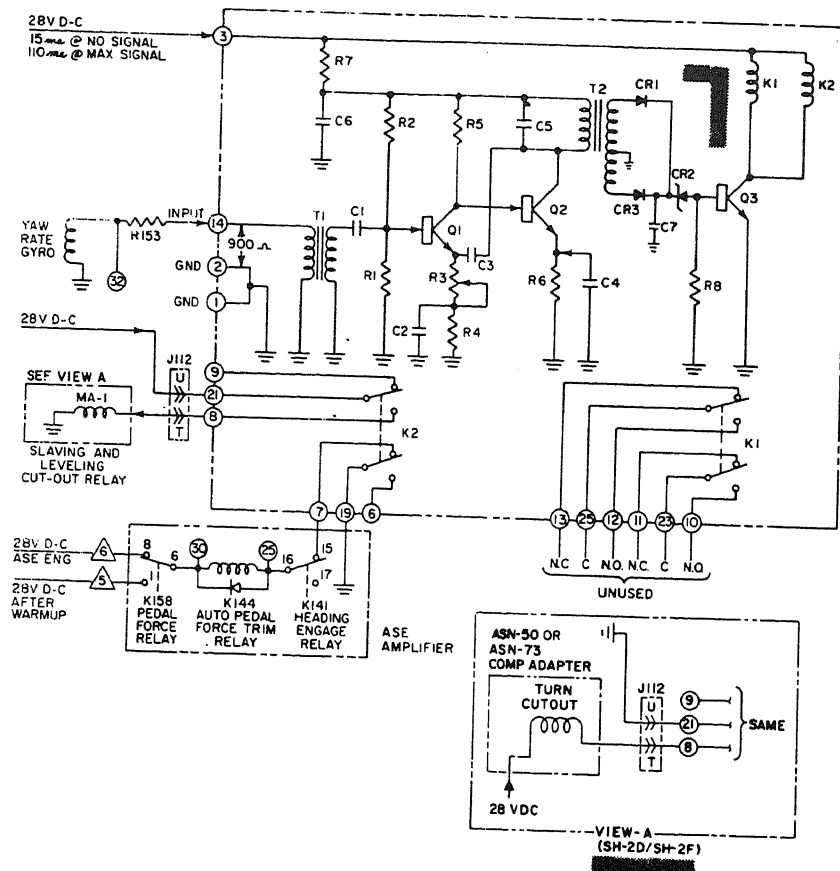
NOTE

The column labeled "checking for" can be used to pinpoint location of signal under test on the ASE system schematic. Figure 1-12, page 1-26.

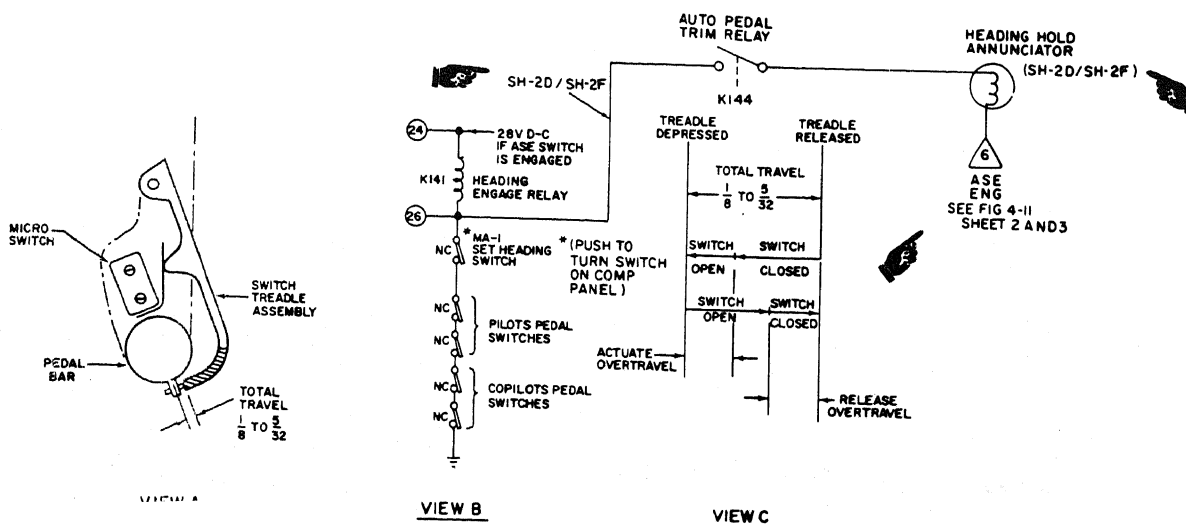
- d. Secure the test sets and notify the instructor that you have completed the test.



Directional Control Schematic and Yaw Axis ASE Block Diagram



Relay Driver Amplifier

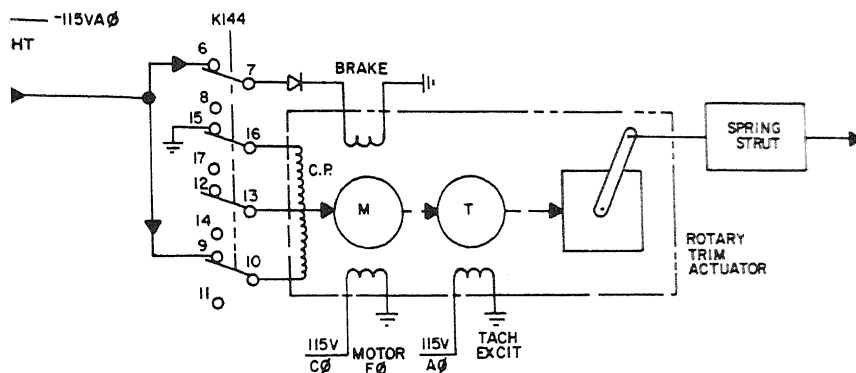


SE AN/ASN-73 ATTITUDE-
2F USES AN/ASN-50 SYSTEM
1. SHEETS 2 AND 3
(17)

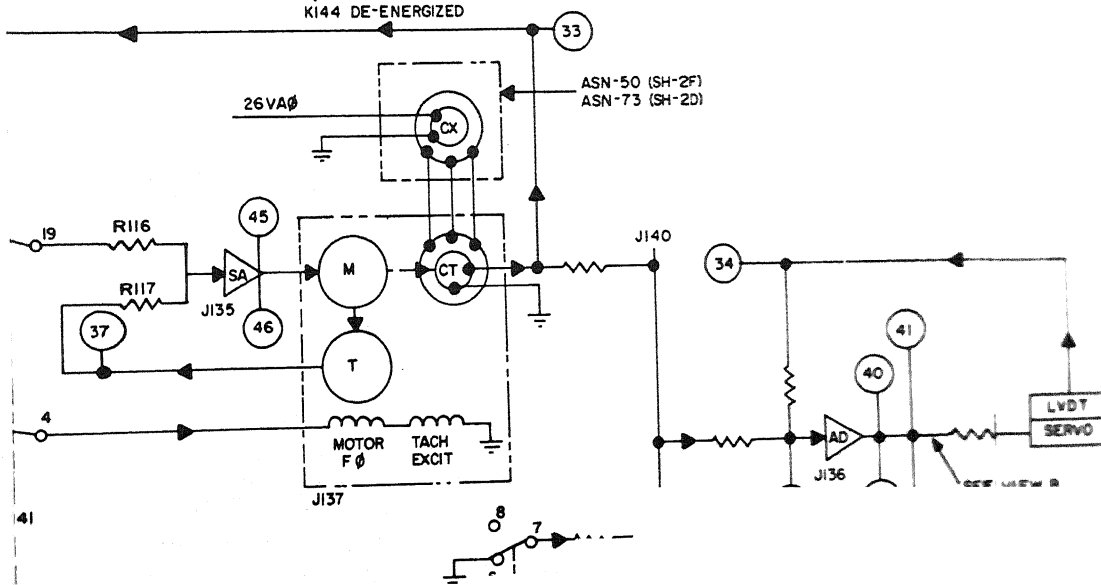
and Copilot's Heading Disengage Switches

— -115VAØ
HT

144



PEDAL TRIM ACTUATOR CONTROL CIRCUIT
(MANUAL MODE)
K144 DE-ENERGIZED



DING HOLD MODE
SYNCHRONIZING)
UNENERGIZED

32
RATE
GYRO

I TITLE: OPERATIONAL CHECK OF YAW CHANNEL

II TOOLS, EQUIPMENT AND MATERIALS

1. SH-2F flight control panel section 1, K603003-5
2. Power cart, K603923-3
3. ASE Flight line test set, K604605-6
4. Manual Maintenance Instruction, NAVAIR 01-260HCD-2-5

III PROCEDURE

1. Flight Line Test Set Hook-up

- a. Insure that the ASE flight line test set is connected as required by paragraph 1-62, 7 through 2N

2. System check

- a. Refer to table 1-1, page 1-28, and complete test 1-7

CAUTION

Always insure that voltmeter range is at 300 during all switch changes, then reduce to proper range for voltmeter readings

NOTE

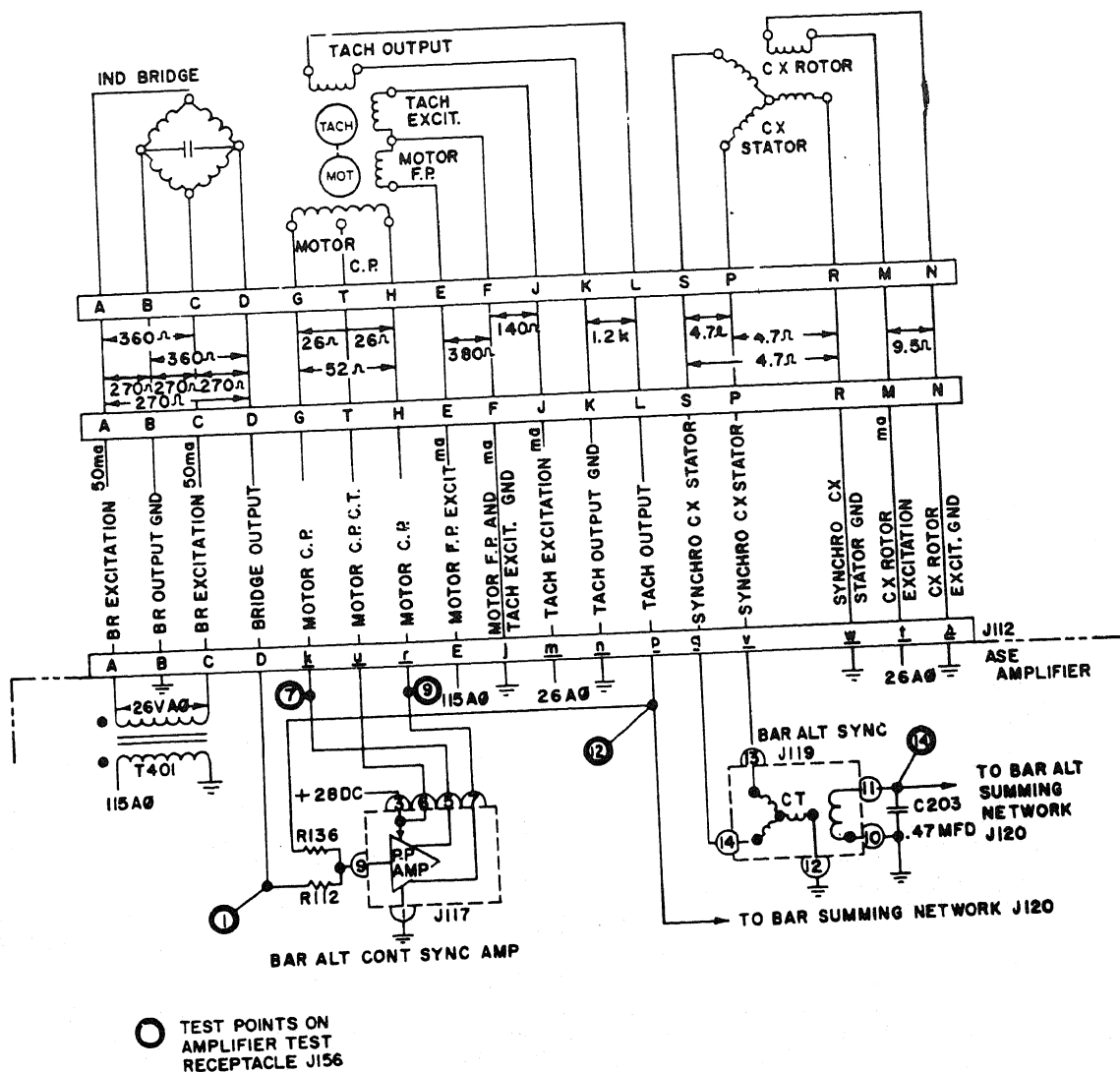
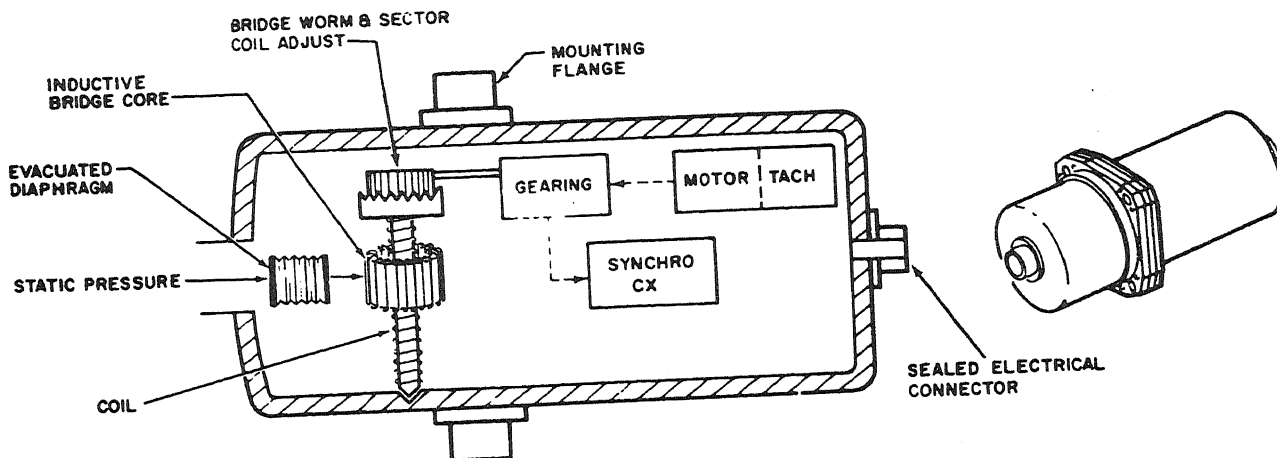
Allow approximately 30 MV deviation due to system noise. Plus and minus readings may NOT have equal values due to noise. Variance in reading up to 50% are acceptable.

- b. Refer to paragraph 1-69, page 1-37, and comply.

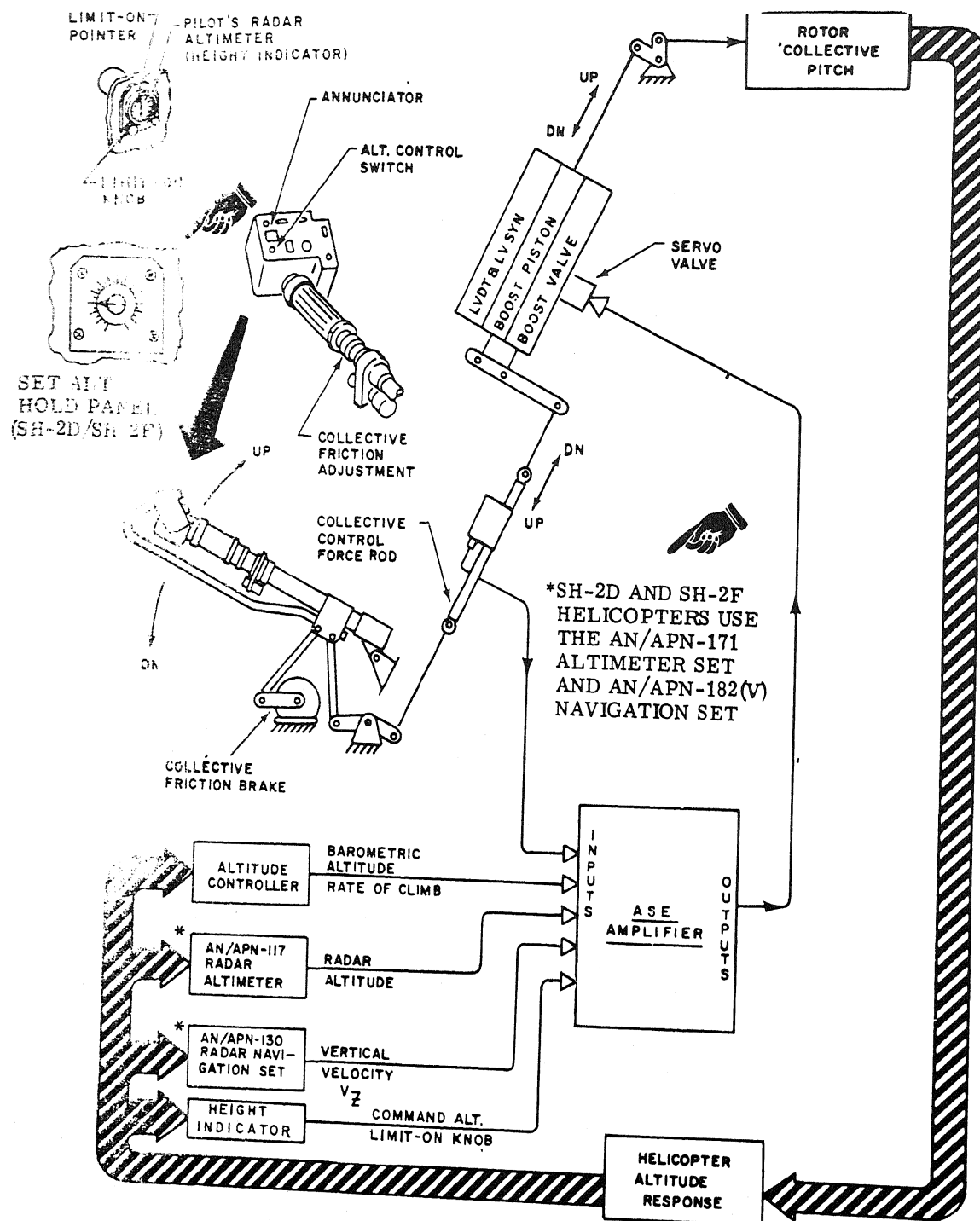
NOTE

The column labeled "checking 1 to pinpoint location of signal the ASE system schematic, fig

- c. Secure the test set and notify the instructor that you have completed the tests.

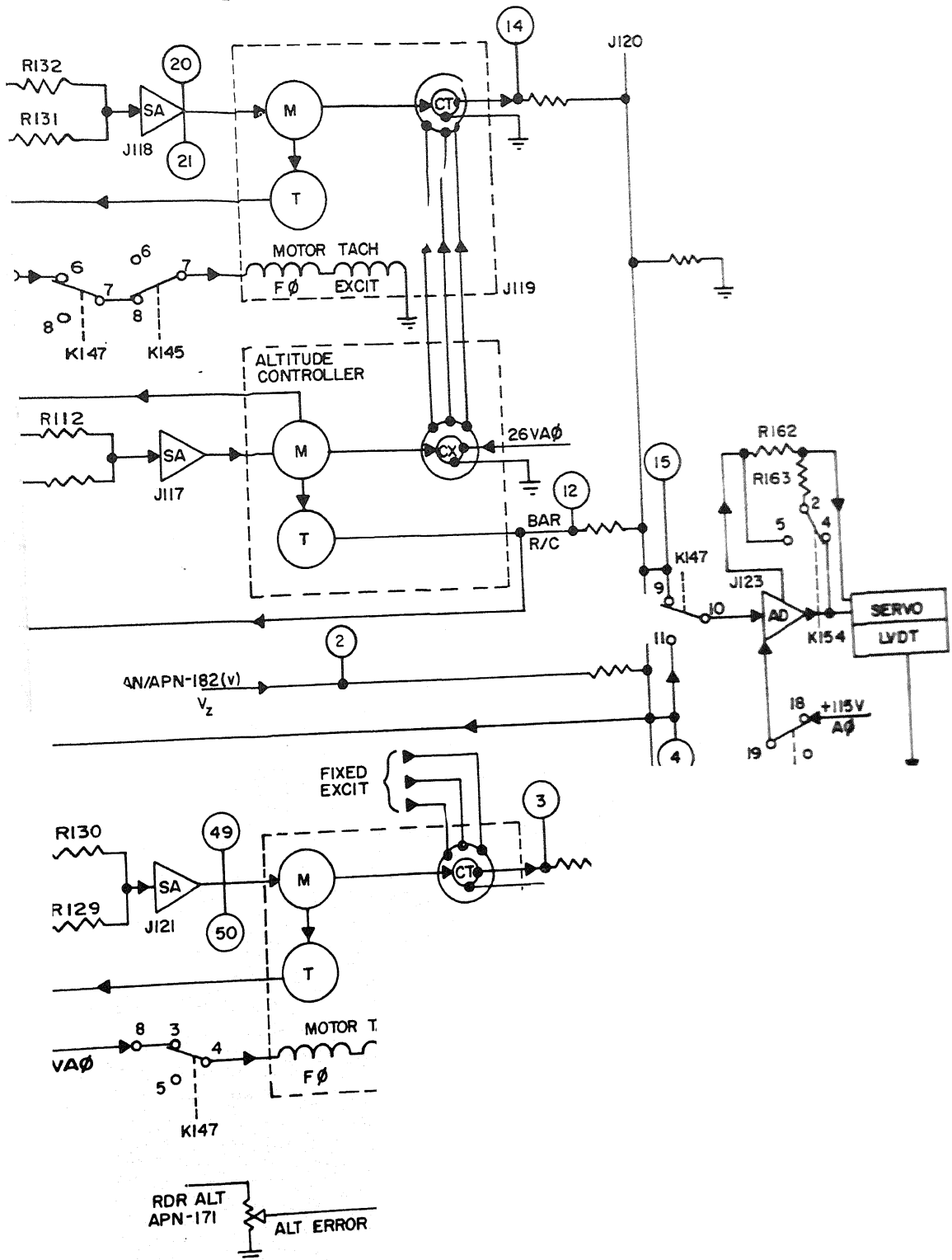


Altitude Controller



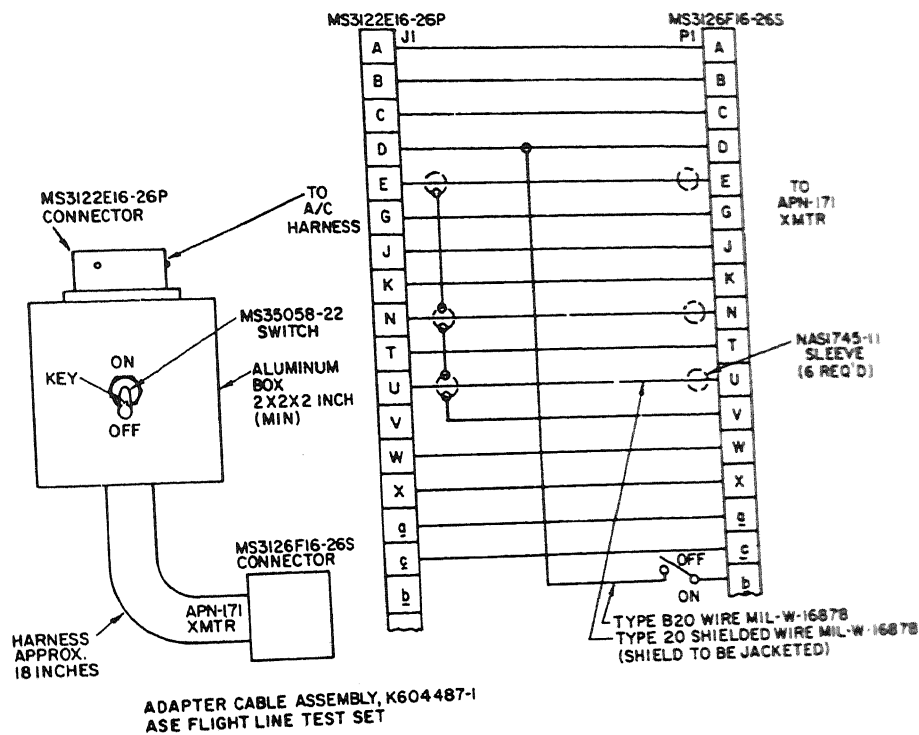
Collective Control Schematic and Altitude Control Block Diagram

ALTITUDE CONTROL MODE ENGAGED



ADAPTER CABLE ASSEMBLY, K604487-1
 (ASE Flight Line Test Set). Adapter cable assembly,
 K604487-1, required for flight line testing of

the ASE System in SH-2D/SH-2F helicopters,
 may be locally manufactured



Adapter Cable Assembly, K604487-1

I TITLE: Operational Check of Collective Channel

II TOOLS, EQUIPMENT AND MATERIALS

1. SH-2F Flight control panel, section 1, K603903-5
2. Power cart, K603923-3
3. ASE flight line test set, K603903-5
4. Manual Maintenance Instruction, NAVAIR 01-250HED-2-5
5. Air Data Test set, VPT-10HS11533

III Procedure

1. Flight line test set hook-up

- a. Insure that the ASE flight line test set is connected as required by paragraph 1-62, 1 through 2n

2. System check

- a. Refer to Table 1-1, page 1-28, and complete test 1-7

CAUTION

Always insure that voltmeter range is at 300 during all switch changes, then reduce to proper range for voltmeter readings

NOTE

Allow approximately 30MV deviation due to system noise. Plus and minus readings may NOT have equal values due to noise. Variance in reading up to 50% are acceptable

- b. Connect the VPT-10HS, using the accessory kit, in accordance with instructions.

CAUTION

Insure that lines are connected properly or serious damage will occur to the system trainer ASE equipment and instruments.

NOTE

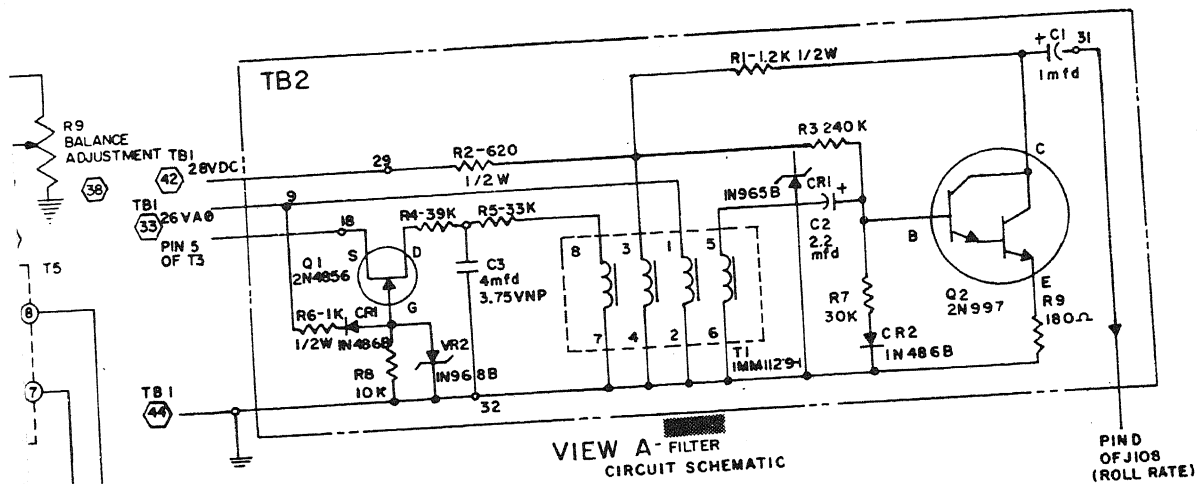
Do NOT operate VPT-10HS until called for during operational check

- c. Refer to paragraph 1-71, page 1-41, and comply

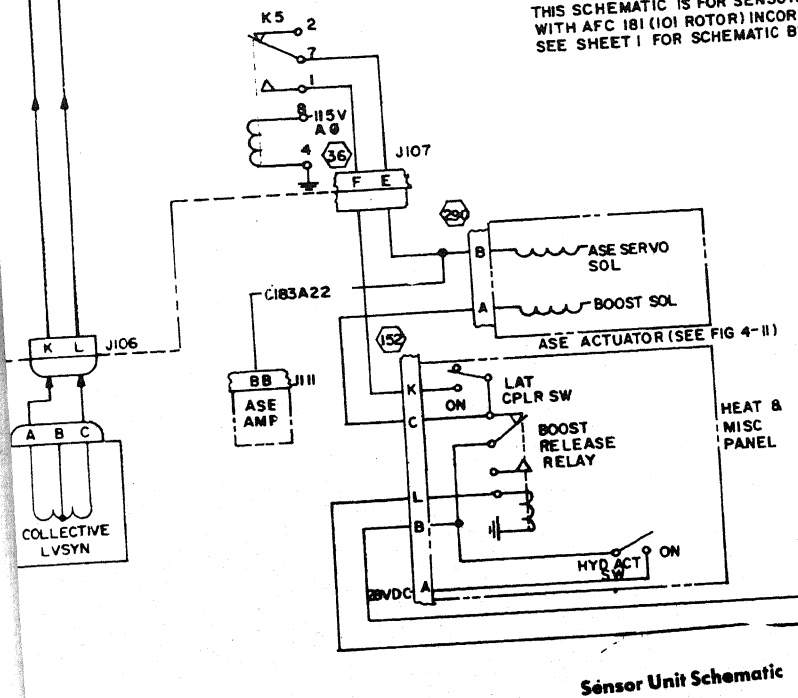
NOTE

The column labeled "checking for" can be used to pinpoint location of signal under test on the ASE system schematic, figure 1-12, page 1-26.

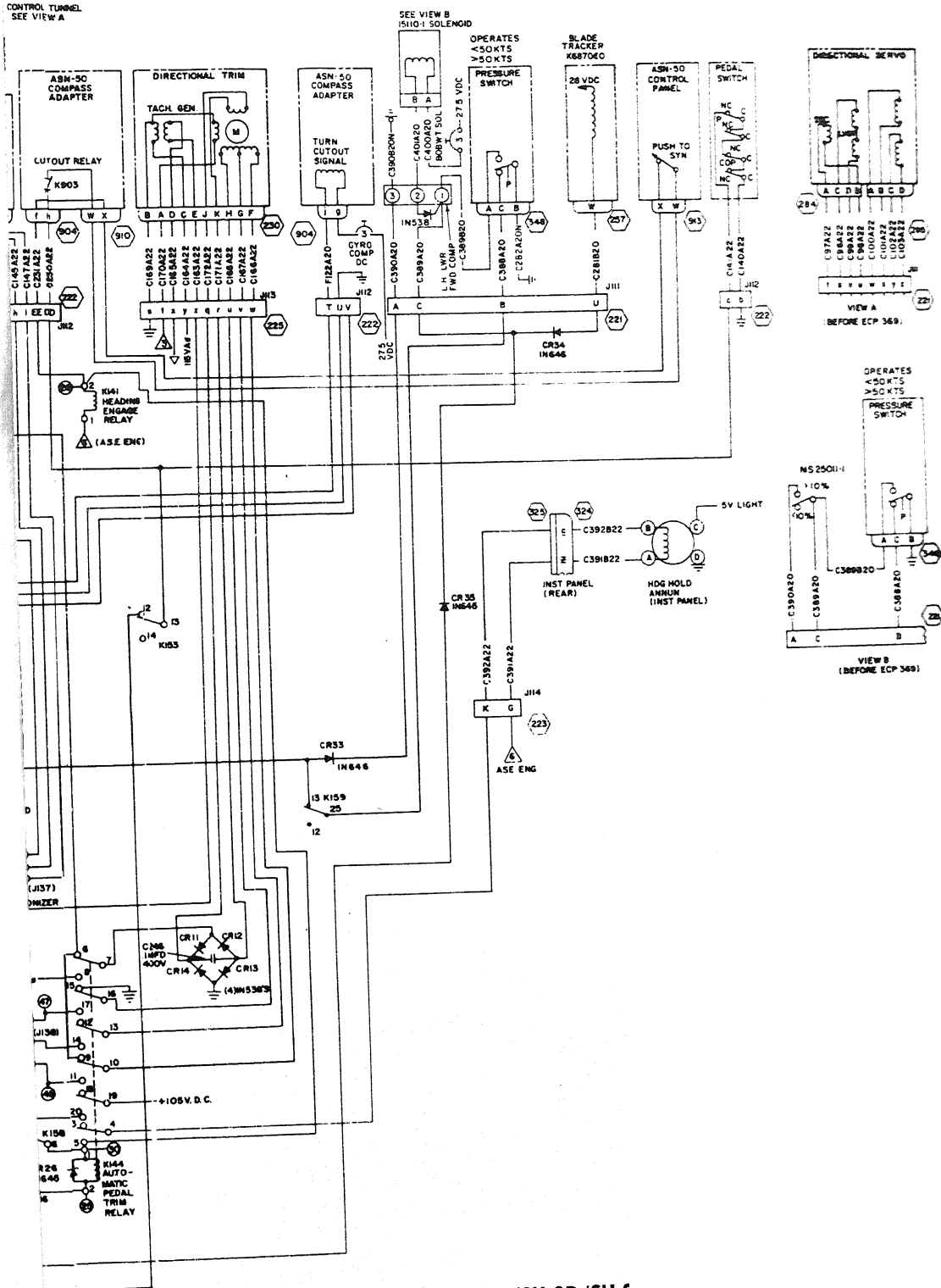
- d. Secure the test set and notify the instructor that you have completed the test.



NOTE:
THIS SCHEMATIC IS FOR SENSOR UNITS
WITH AFC 181 (101 ROTOR) INCORPORATED.
SEE SHEET 1 FOR SCHEMATIC BEFORE AFC 181.



CONTROL TUNNEL
SEE VIEW A



ASE System Schematic (SH-2D/SH-1)
After AFC 181 and ECP 369